ProSoft TECHNOLOGY

Where Automation Connects.

inRAx®

MVI69L-MBTCP

CompactLogix Platform

Modbus TCP/IP Lite
Communication Module

January 6, 2014

USER MANUAL

Your Feedback Please

We always want you to feel that you made the right decision to use our products. If you have suggestions, comments, compliments or complaints about our products, documentation, or support, please write or call us.

How to Contact Us

ProSoft Technology
5201 Truxtun Ave., 3rd Floor
Bakersfield, CA 93309
+1 (661) 716-5100
+1 (661) 716-5101 (Fax)
www.prosoft-technology.com
support@prosoft-technology.com

Copyright © 2014 ProSoft Technology, Inc., All rights reserved.

MVI69L-MBTCP User Manual

January 6, 2014

ProSoft Technology ®, ProLinx ®, inRAx ®, ProTalk ®, and RadioLinx ® are Registered Trademarks of ProSoft Technology, Inc. All other brand or product names are or may be trademarks of, and are used to identify products and services of, their respective owners.

In an effort to conserve paper, ProSoft Technology no longer includes printed manuals with our product shipments. User Manuals, Datasheets, Sample Ladder Files, and Configuration Files are provided on the enclosed DVD, and are available at no charge from our web site: http://www.prosoft-technology.com

Content Disclaimer

This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither ProSoft Technology nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. Information in this document including illustrations, specifications and dimensions may contain technical inaccuracies or typographical errors. ProSoft Technology makes no warranty or representation as to its accuracy and assumes no liability for and reserves the right to correct such inaccuracies or errors at any time without notice. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of ProSoft Technology. All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components. When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use ProSoft Technology software or approved software with our hardware products may result in injury, harm, or improper operating results. Failure to observe this information can result in injury or equipment damage.

© 2014 ProSoft Technology. All rights reserved.

Printed documentation is available for purchase. Contact ProSoft Technology for pricing and availability.

North America: +1.661.716.5100

Asia Pacific: +603.7724.2080

Europe, Middle East, Africa: +33 (0) 5.3436.87.20

Latin America: +1.281.298.9109

Important Safety Information - MVI69L-MBTCP

North America Warnings

A This Equipment is Suitable For Use in Class I, Division 2, Groups A, B, C, D or Non-Hazardous Locations Only.
B Warning – Explosion Hazard – Substitution of Any Components May Impair Suitability for Class I, Division 2.
C Warning – Explosion Hazard – Do Not Disconnect Equipment Unless Power Has Been Switched Off Or The Area is Known To Be Non-Hazardous.
D The subject devices are powered by a Switch Model Power Supply (SMPS) that has regulated output voltage of 5 VDC.

ATEX Warnings and Conditions of Safe Usage:

Power, Input, and Output (I/O) wiring must be in accordance with the authority having jurisdiction

A Warning - Explosion Hazard - When in hazardous locations, turn off power before replacing or wiring modules.
B Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
C These products are intended to be mounted in an IP54 enclosure. The devices shall provide external means to prevent the rated voltage being exceeded by transient disturbances of more than 40%. This device must be used only with ATEX certified backplanes.

- DO NOT OPEN WHEN ENERGIZED

Agency Approvals and Certifications

Agency
ATEX; Category 3, Zone 2
CE Mark
CSA; CB Safety
Environmental
KCC
RoHS Compliant
UL/cUL; Class 1, Div. 2 Groups A, B, C, D

Contents

Your Feedback Please 2
How to Contact Us 2
Important Safety Information - MVI69L-MBTCP 3

1 Start Here 9

1.1 System Requirements 10
1.2 Deployment Checklist 11
1.3 Package Contents 11
1.4 Setup Jumper 12
1.5 Installing the Module in the Rack 13
1.6 DVD Contents 16

2 Add-On Instruction 17

2.1 Installing ProSoft Configuration Builder 18
2.2 Generating the AOI (.L5X) File in ProSoft Configuration Builder 19
2.2.1 Creating a New Project in PCB 19
2.2.2 Exporting the .L5X File from PCB 22
2.3 Creating a New RSLogix 5000 Project 24
2.4 Creating the Module in an RSLogix 5000 Project 25
2.4.1 Installing an Add-On Profile 25
2.4.2 Creating a Module in the Project Using an Add-On Profile 27
2.4.3 Creating a Module in the Project Using a Generic 1769 Module Profile 29
2.5 Importing the Add-On Instruction 33
2.6 Adding Multiple Modules in the Rack (Optional) 36
2.6.1 Adding a New Module in PCB 36
2.6.2 Adding a new module in RSLogix 5000 38

3 MVI69L-MBTCP Configuration 45

3.1 Basic PCB Functions 46
3.1.1 Creating a New PCB Project and Exporting an .L5X File 46
3.1.2 Renaming PCB Objects 46
3.1.3 Editing Configuration Parameters 46
3.1.4 Printing a Configuration File 48
3.2 Module Configuration Parameters 49
3.2.1 Module 49
3.2.2 MBTCP Servers 50
3.2.3 MBTCP Client x 52
3.2.4 MBTCP Client x Commands 55
3.2.5 Ethernet 1 58
3.2.6 Static ARP Table 59
3.3 Downloading the Configuration File to the Processor 60
3.4 Uploading the Configuration File from the Processor 63

4 Backplane Data Exchange 67

4.1 Backplane Data Transfer 68

4.2 Normal Data Transfer ... 69
4.2.1 Write Block: Request from the Processor to the Module ... 69
4.2.2 Read Block: Response from the Module to the Processor ... 69
4.2.3 Read and Write Block Transfer Sequences ... 70
4.3 Data Flow Between the Module and Processor ... 71
4.3.1 Server Driver Overview ... 71
4.3.2 Client Driver Overview ... 73

5 Using Controller Tags 75

5.1 Controller Tags ... 76
5.1.1 MVI69L-MBTCP Controller Tags ... 76
5.2 User-Defined Data Types (UDTs) ... 78
5.2.1 MVI69L-MBTCP User-Defined Data Types ... 78
5.3 Controller Tag Overview ... 80
5.3.1 MBTCP.CONFIG ... 80
5.3.2 MBTCP.DATA ... 80
5.3.3 MBTCP.CONTROL ... 81
5.3.4 MBTCP.STATUS ... 86
5.3.5 MBTCP.UTIL ... 89

6 Diagnostics and Troubleshooting 91

6.1 Ethernet LED Indicators ... 92
6.2 LED Status Indicators ... 92
6.2.2 Troubleshooting the LEDs ... 93
6.3 Connecting the PC to the Module's Ethernet Port ... 94
6.3.1 Setting Up a Temporary IP Address ... 94
6.4 Connecting to the Diagnostics Menu in ProSoft Configuration Builder ... 97
6.4.1 Diagnostics Menu ... 99
6.4.2 Monitoring General Information ... 99
6.4.3 Monitoring Network Configuration Information ... 100
6.4.4 Monitoring Backplane Status Information ... 100
6.4.5 Modbus Server Driver Information ... 101
6.4.6 Monitoring Data Values in the Module's Database ... 102
6.4.7 Modbus Client Driver Information ... 102
6.5 Communication Error Codes ... 103
6.6 Connecting to the Module's Webpage ... 104

7 Reference 105

7.1 Product Specifications ... 106
7.1.1 General Specifications - Modbus Client/Server ... 106
7.1.2 Hardware Specifications ... 107
7.2 About the Modbus Protocol ... 108
7.2.1 Commands Supported by the Module ... 109
7.2.2 Read Coil Status (Function Code 01) ... 109
7.2.3 Read Input Status (Function Code 02) ... 110
7.2.4 Read Holding Registers (Function Code 03) ... 112
7.2.5 Read Input Registers (Function Code 04) ... 113
7.2.6 Force Single Coil (Function Code 05) ... 113
7.2.7 Preset Single Register (Function Code 06) ... 115
7.2.8 Diagnostics (Function Code 08) ... 115

7.2.9 Force Multiple Coils (Function Code 15) 118
7.2.10 Preset Multiple Registers (Function Code 16) 119
7.3 Floating-Point Support 120
7.3.1 ENRON Floating-Point Support 120
7.3.2 Configuring Floating-Point Data Transfer 121
7.4 Function Blocks 126
7.4.1 Event Command Blocks 127
7.4.2 Client Status Request/Response Blocks 128
7.4.3 Event Sequence Request Blocks 129
7.4.4 Event Sequence Command Error Status Blocks 130
7.4.5 Get Queue and Event Sequence Block Counts Block 131
7.4.6 Command Control Blocks 132
7.4.7 Add Event with Data for Client Blocks 133
7.4.8 Get Event with Data Status Block 134
7.4.9 Get General Module Status Data Block 135
7.4.10 Set Driver and Command Active Bits Block 137
7.4.11 Get Driver and Command Active Bits Block 138
7.4.12 Pass-through Formatted Block for Functions 6 and 16 with Word Data Block 139
7.4.13 Pass-through Formatted Block for Functions 6 and 16 with Float Data Block 140
7.4.14 Pass-through Formatted Block for Function 5 141
7.4.15 Pass-through Formatted Block for Function 15 142
7.4.16 Pass-through Formatted Block for Function 22 143
7.4.17 Pass-through Formatted Block for Function 23 143
7.4.18 Pass-through Block for Function 99 144
7.4.19 Set Module Time Using Received Time Block 145
7.4.20 Pass Module Time to Processor Block 145
7.4.21 Reset Status Block 146
7.4.22 Warm-boot Control Block 147
7.4.23 Cold-boot Control Block 147
7.5 Ethernet Cable Connections 148
7.5.1 Ethernet Cable Specifications 148
7.5.2 Ethernet Performance 148

8 Support, Service & Warranty 149

8.1 Contacting Technical Support 149
8.2 Warranty Information 150

Index 151

1 Start Here

In This Chapter

- System Requirements 10
- Deployment Checklist 11
- Package Contents 11
- Setup Jumpers 12
- Installing the Module in the Rack 13
- DVD Contents 16

To get the most benefit from this User Manual, the user should have the following skills:

- **Rockwell Automation® RSLogix™ software:** launch the program, configure ladder logic, and transfer the ladder logic to the processor
- **Microsoft Windows:** install and launch programs, execute menu commands, navigate dialog boxes, and enter data
- **Hardware installation and wiring:** install the module, and safely connect Modbus and CompactLogix devices to a power source and to the MVI69L-MBTCP module's Ethernet port

1.1 System Requirements

The MVI69L-MBTCP module requires the following minimum hardware and software components:

- Rockwell Automation CompactLogix® processor (firmware version 10 or higher), with compatible power supply, and one free slot in the rack for the MVI69L-MBTCP module.

Important: The MVI69L-MBTCP module has a power supply distance rating of 4 (L43 and L45 installations on first 2 slots of 1769 bus). It consumes 450 mA at 5 Vdc.

- The module requires 450 mA of available 5 Vdc power
- Rockwell Automation RSLogix 5000 programming software version 16 or higher
- Rockwell Automation RSLinx® communication software version 2.51 or higher
- ProSoft Configuration Builder (PCB) (included)
- ProSoft Discovery Service (PDS) (included in PCB)
- Pentium® II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
  - Microsoft Windows® 7
  - Microsoft Windows Vista
  - Microsoft Windows XP Professional with Service Pack 1 or 2
  - Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
  - Microsoft Windows Server 2003
- 128 Mbytes of RAM minimum, 256 Mbytes of RAM recommended
- 100 Mbytes of free hard disk space (or more based on application requirements)
- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 × 768 recommended)
- DVD drive

Note: The Hardware and Operating System requirements in this list are the minimum recommended to install and run software provided by ProSoft Technology®. Other third party applications may have different minimum requirements. Refer to the documentation for any third party applications for system requirements.

1.2 Deployment Checklist

Before configuring the module, consider the following questions.

1 _____ Is this a new application or an integration into an existing application?

Most applications will use the Sample Add-On Instruction without any edits.

2 _____ What slot number in the rack will the MVI69L-MBTCP module occupy?

3 _____ Are RSLogix 5000 and RSLinx software installed?

RSLogix and RSLinx are required to communicate to the CompactLogix processor.

4 _____ How many words of data are needed to transfer in the application (from CompactLogix to Module / to CompactLogix from Module)?

1.3 Package Contents

The following components are included with the MVI69L-MBTCP module, and are all required for installation and configuration.

Important: Before beginning the installation, please verify all of the following items are present.

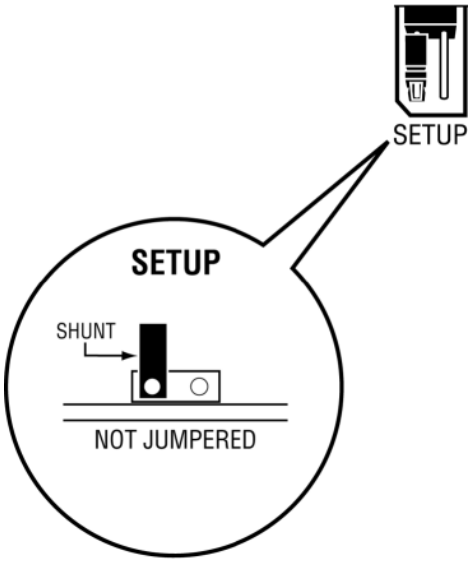
Qty.	Part Name	Part Number	Part Description
1	MVI69L-MBTCP Module	MVI69L-MBTCP	Modbus communication module
1	Ethernet Cable	RL-CBL025	Ethernet straight-through cable
1	ProSoft Solutions DVD	DVD-001	Contains ProSoft Configuration Builder (PCB) and ProSoft Discovery Service (PDS) software. Files can also be found at www.prosoft-technology.com

If any of these components are missing, please contact ProSoft Technology Support for replacement parts.

1.4 Setup Jumper

The Setup Jumper acts as "write protection" for the module's firmware. In "write protected" mode, the Setup pins are not connected, and the module's firmware cannot be overwritten. The module is shipped with the Setup jumper OFF. If an update of the firmware is needed, apply the Setup jumper to both pins.

The following illustration shows the MVI69L-MBTCP jumper configuration, with the Setup Jumper OFF.



1.5 Installing the Module in the Rack

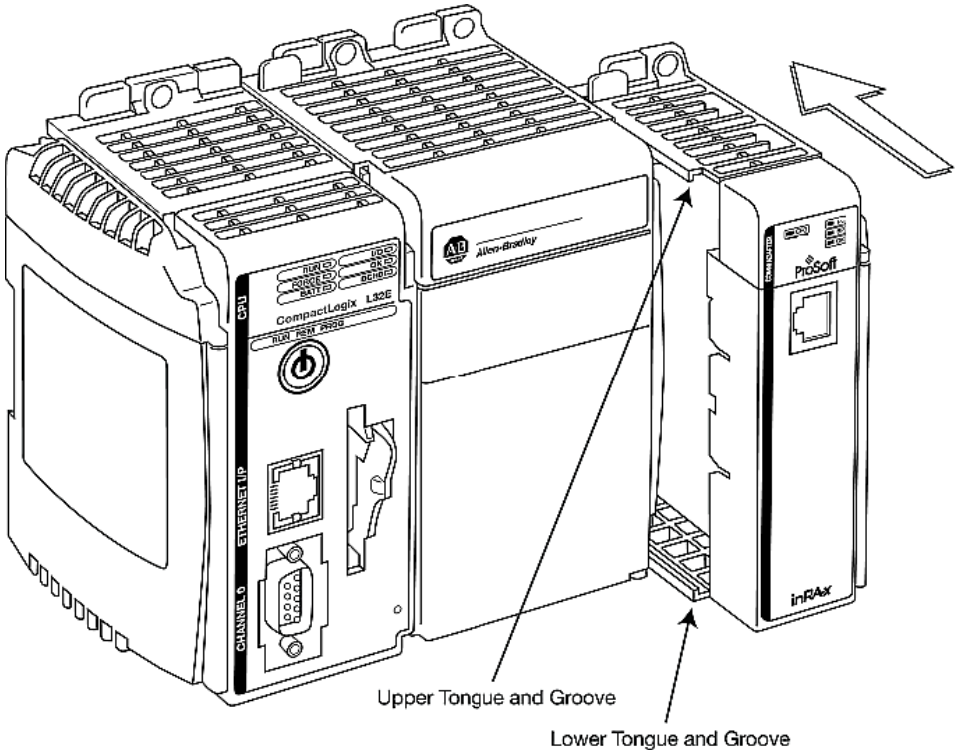
Make sure the processor and power supply are installed and configured before installing the MVI69L-MBTCP module. Refer to the Rockwell Automation product documentation for installation instructions.

Warning: Please follow all safety instructions when installing this or any other electronic devices. Failure to follow safety procedures could result in damage to hardware or data, or even serious injury or death to personnel. Refer to the documentation for each device to be connected to verify that suitable safety procedures are in place before installing or servicing the device.

After the jumper placements are verified, insert the MVI69L-MBTCP into the rack. Use the same technique recommended by Rockwell Automation to remove and install CompactLogix modules.

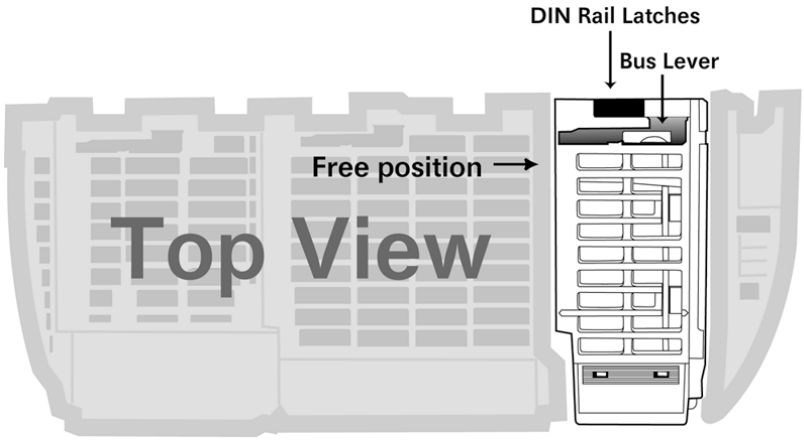
Warning: This module is not hot-swappable! Always remove power from the rack before inserting or removing this module, or damage may result to the module, the processor, or other connected devices.

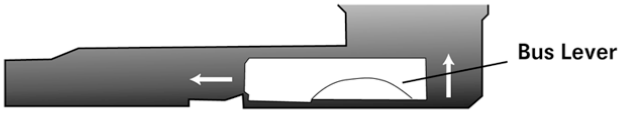
1 Align the module using the upper and lower tongue-and-groove slots with the adjacent module and slide forward in the direction of the arrow.



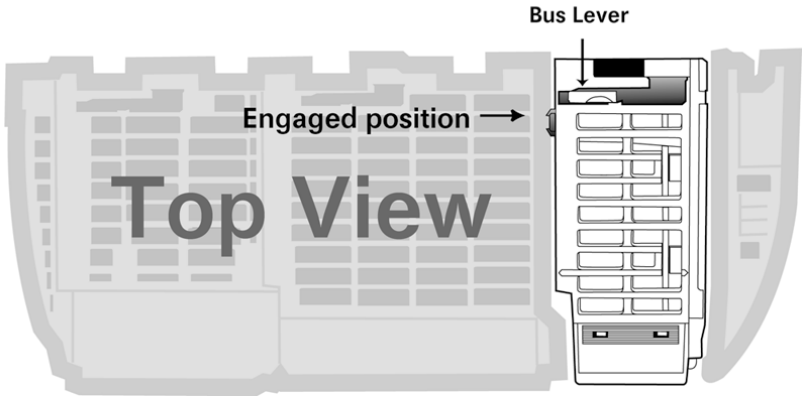
2 Move the module back along the tongue-and-groove slots until the bus connectors on the MVI69 module and the adjacent module line up with each other.

3 Push the module's bus lever back slightly to clear the positioning tab and move it firmly to the left until it clicks. Ensure that it is locked firmly in place.



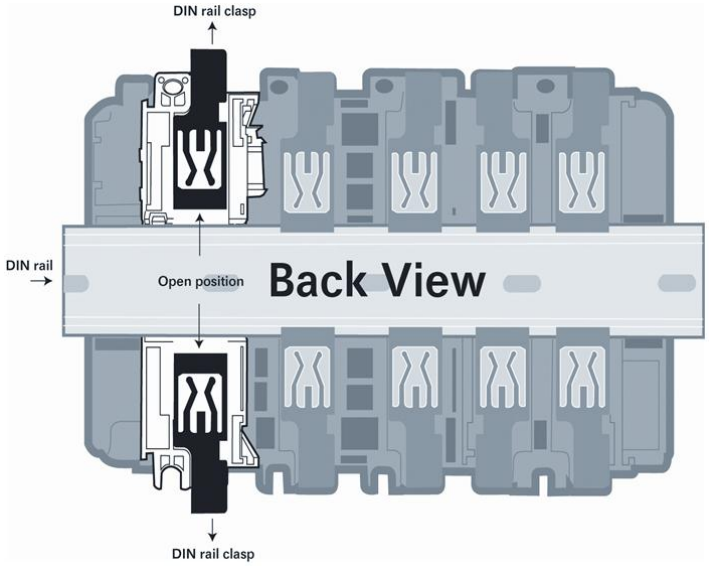


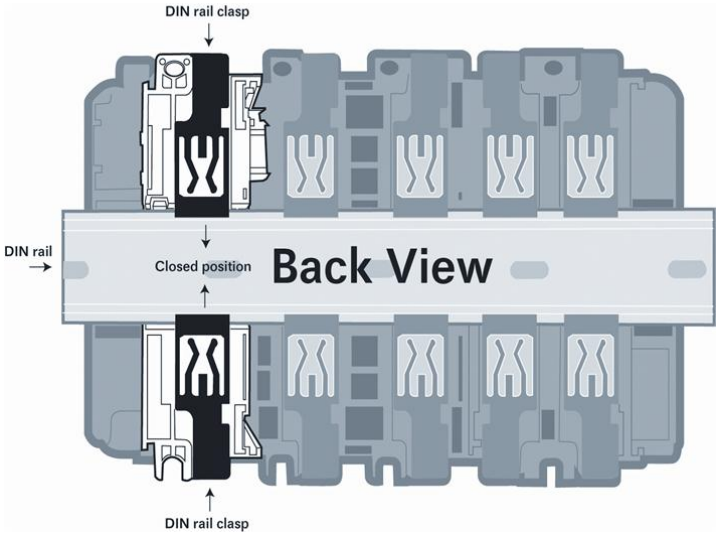
Move the Bus Lever to the left until it clicks



4 Close all DIN-rail latches.

5 Press the DIN-rail mounting area of the controller against the DIN-rail. The latches will momentarily open and lock into place.





1.6 DVD Contents

The DVD contains all the necessary files for the module. The User Manual, ProSoft Configuration Builder (PCB), and the sample Add-On Instruction are among the files.

If the DVD is not present, please visit www.prosoft-technology.com for the latest files.

2 Add-On Instruction

In This Chapter

- Installing ProSoft Configuration Builder 18
- Generating the AOI (.L5X) File in ProSoft Configuration Builder 19
- Creating a New RSLogix 5000 Project 24
- Creating the Module in an RSLogix5000 Project 25
- Importing the Add-On Instruction 33
- Adding Multiple Modules in the Rack (Optional) 36

The .L5X file contains the Add-On Instruction (AOI), user-defined data types, controller tags and ladder logic required to configure the MVI69L-MBTCP module. This file is generated by ProSoft Configuration Builder software and imported into RSLogix 5000.

2.1 Installing ProSoft Configuration Builder

The ProSoft Configuration Builder installation file can be found on the product DVD or from our web site: http://www.prosoft-technology.com. The filename contains the version of PCB. For example, **PCB_4.1.0.4.0206.exe**

Copy the installation file to the local hard drive and run the **PCB.exe** file to start the InstallShield Wizard. Follow the InstallShield Wizard to properly install PCB.

ProSoft Configuration Builder - InstallShield Wizard
Welcome to the InstallShield Wizard for ProSoft Configuration Builder
The InstallShield Wizard will install ProSoft Configuration Builder on your computer. To continue, click Next.
ProSoft
TECHNOLOGY
< Back
Next >
Cancel

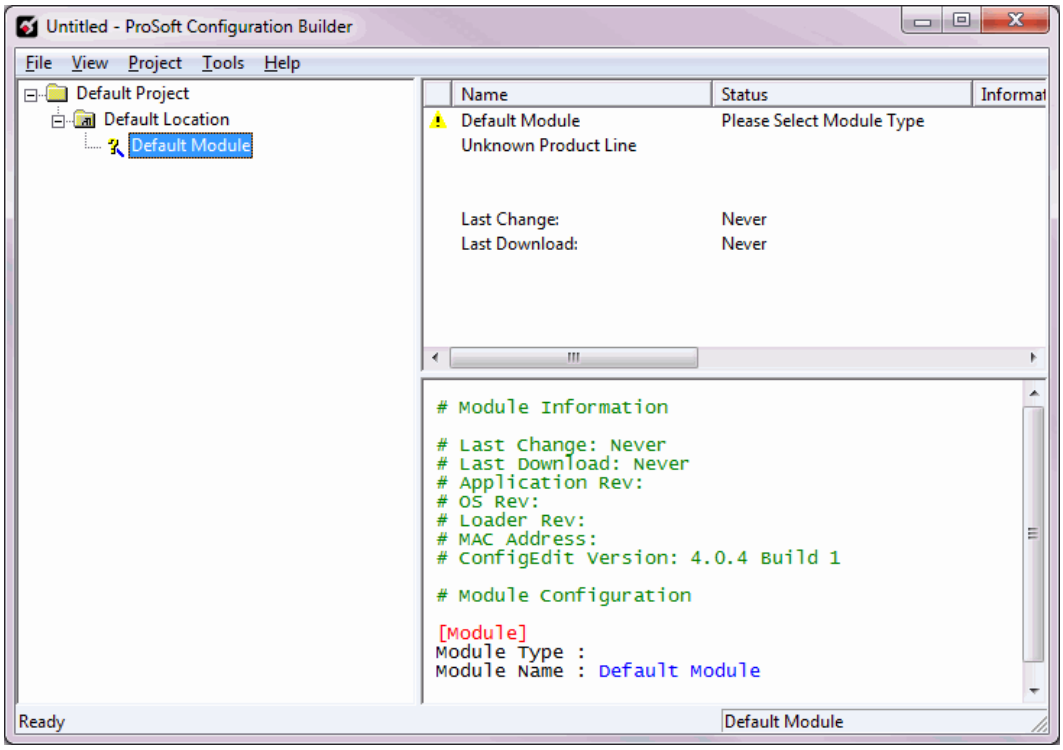
2.2 Generating the AOI (.L5X) File in ProSoft Configuration Builder

The following sections describe the steps required to set up a new configuration project in ProSoft Configuration Builder (PCB), and to export the .L5X file for the project.

2.2.1 Creating a New Project in PCB

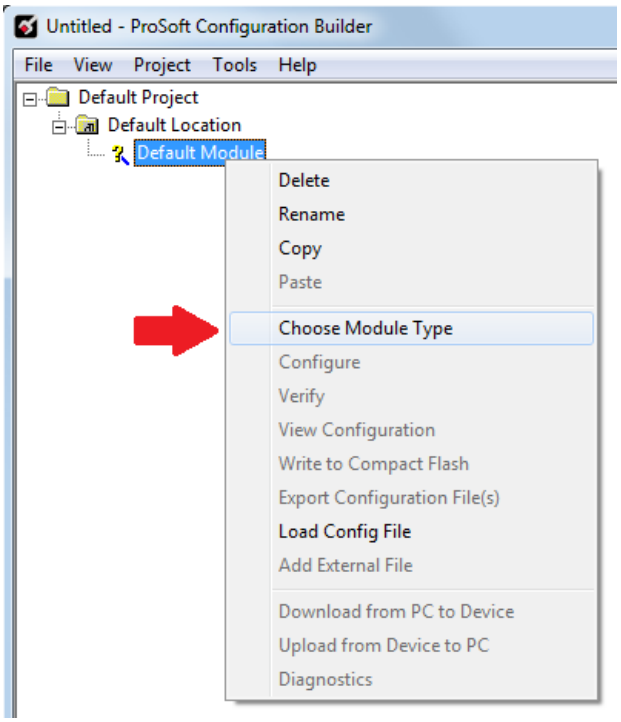
To begin, start the PCB software. PCB's window consists of a tree view on the left, and an information pane and configuration pane on the right side of the window.

The tree view consists of folders for *Default Project* and *Default Location*, with a *Default Module* in the *Default Location* folder. The following illustration shows the *ProSoft Configuration Builder* window with a new project.

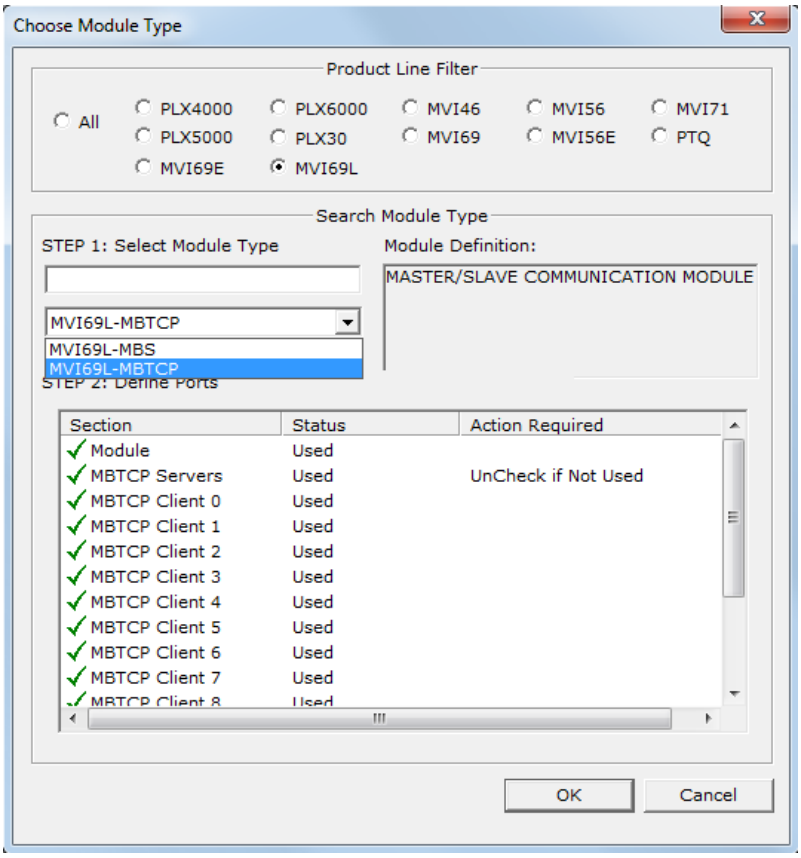


To add the MVI69L-MBTCP module to the project

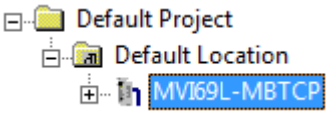
1 In the tree view, right-click **DEFAULT MODULE**. Select **CHOOSE MODULE TYPE** from the shortcut menu. This action opens the *Choose Module Type* dialog box.



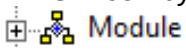
2 In the *Product Line Filter* area of the dialog box, click the **MVI69L** radio button. In the *Select Module Type* dropdown list, select **MVI69L-MBTCP**, and click **OK** to save the settings and return to the *ProSoft Configuration Builder* window.



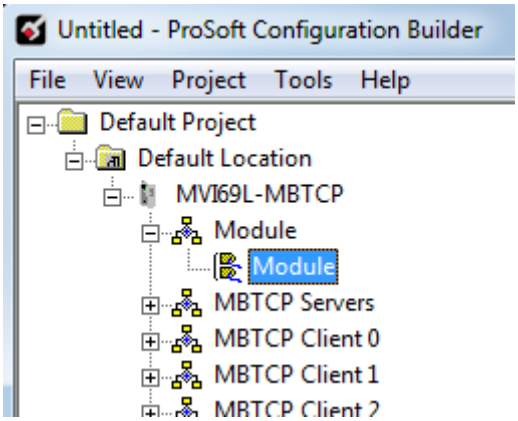
3 The MVI69L-MBTCP module icon will now be visible in the tree view.



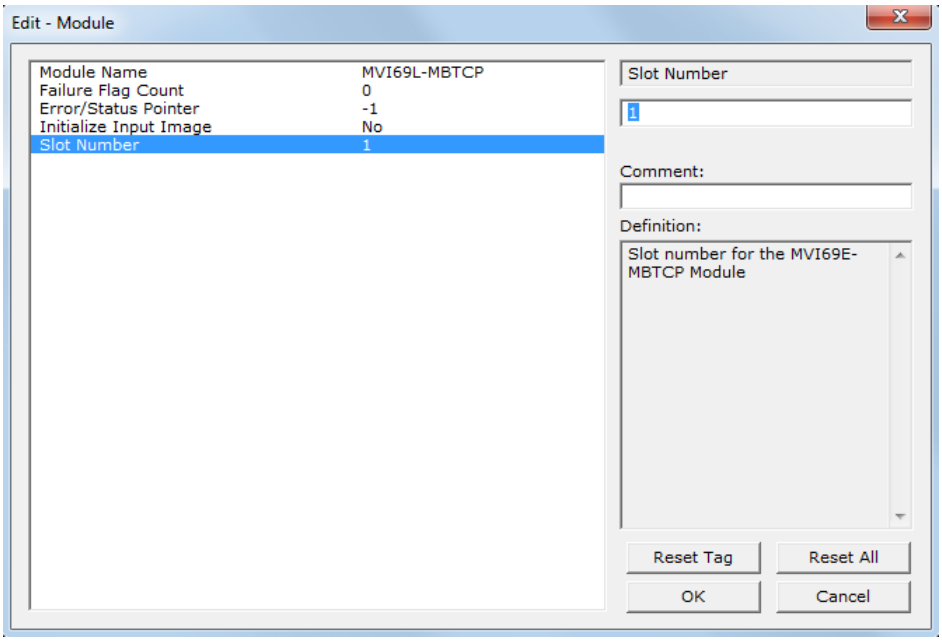
2.2.2 Exporting the .L5X File from PCB

1 Expand the **MVI69L-MBTCP** icon by clicking the **[+]** symbol beside it. Similarly, expand the 

icon. Double-click the **Module** icon to open the *Edit - Module* dialog box.

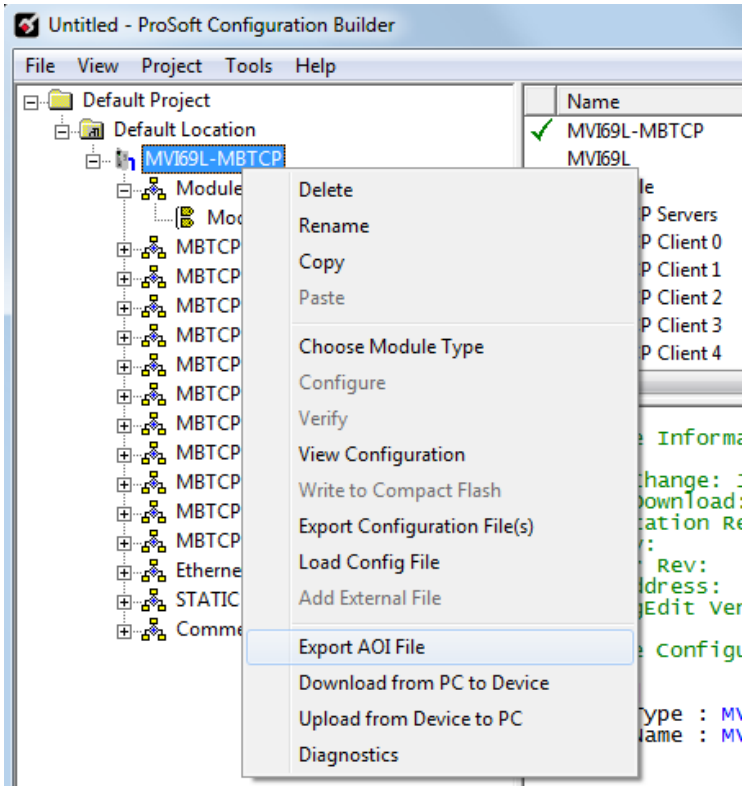


2 Edit the *Slot Number* indicating where the module will be placed in the 1769 bus. The *Slot Number* parameter in the PCB configuration affects the format of the .L5X file that is exported. This parameter identifies the residing slot of the module in the CompactLogix rack.

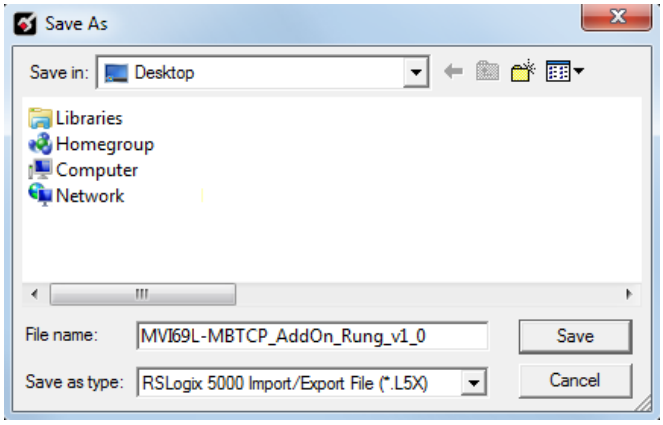


3 Click **OK** to close the *Edit – Module* dialog box. The .L5X file is now ready to be exported to the PC/Laptop.

4 Right-click the **MVI69L-MBTCP** icon in the project tree and select **EXPORT AOI FILE**.

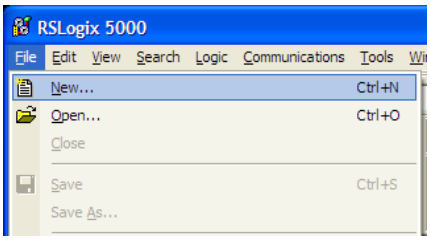


5 Save the .L5X file to the PC/Laptop in an easily found location, such as Windows Desktop.



2.3 Creating a New RSLogix 5000 Project

1 Open the **FILE** menu, and select **NEW**.

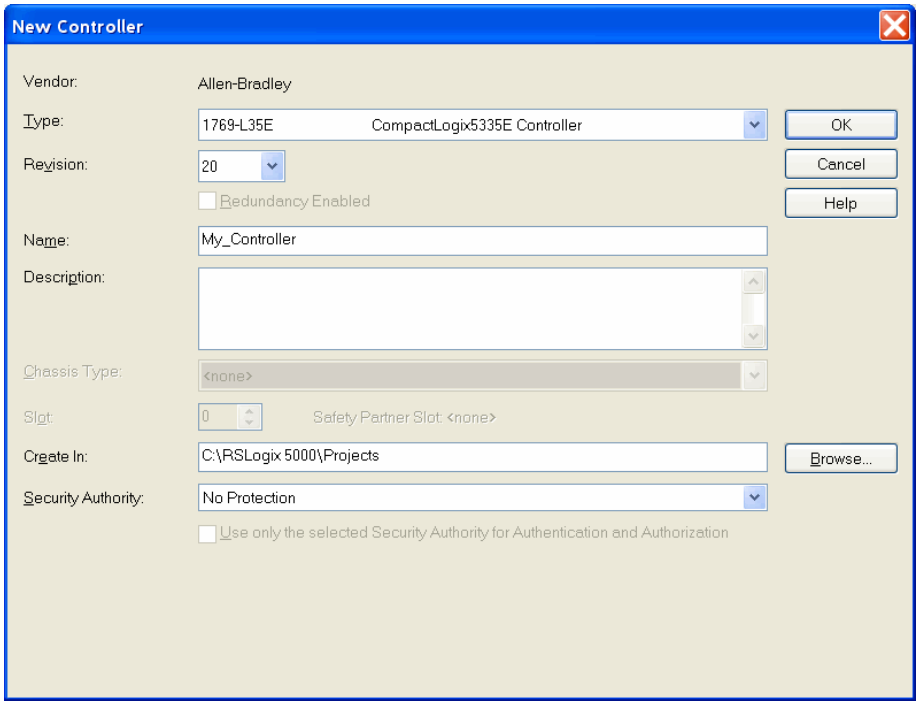


2 Select the CompactLogix processer model.

3 Select **REVISION 16** or newer.

4 Enter a name for the processor, such as *My_Controller*.

5 Select the CompactLogix chassis type.



2.4 Creating the Module in an RSLogix 5000 Project

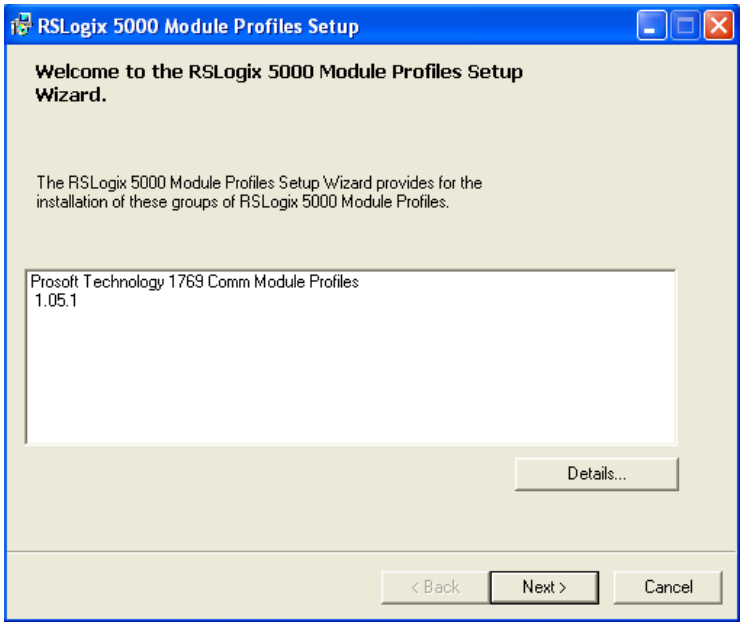
In an RSLogix 5000 project, an Add-On Profile (AOP) can be used to specifically identify the MVI69L-MBTCP when selecting the type of module to be installed in slot x. Add-On Profiles are supported in RSLogix 5000 version 15 and newer.

If using an AOP is not an option, please see page 29 to install the module using a *Generic 1769 Module* profile.

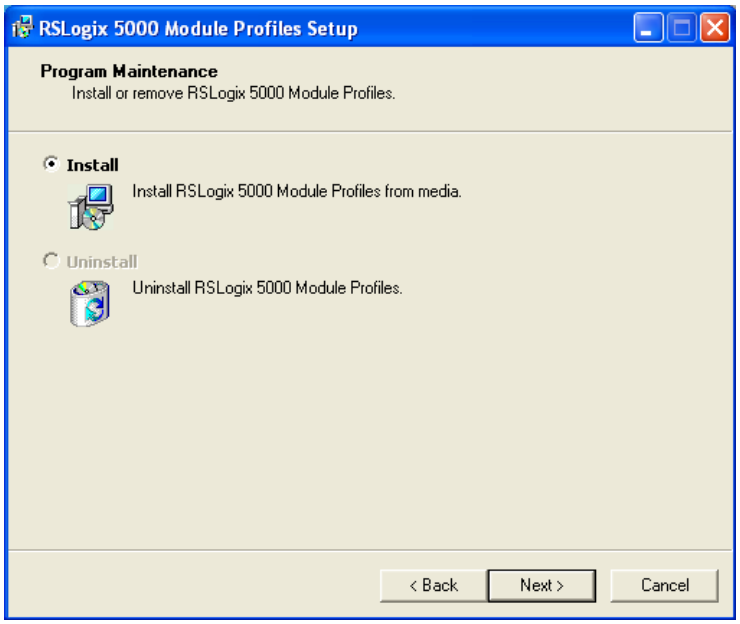
2.4.1 Installing an Add-On Profile

Download the **MPSetup.exe** file from the product webpage or DVD onto the local hard drive. Make sure RSLogix 5000 and RSLinx has been shut down before installing the AOP.

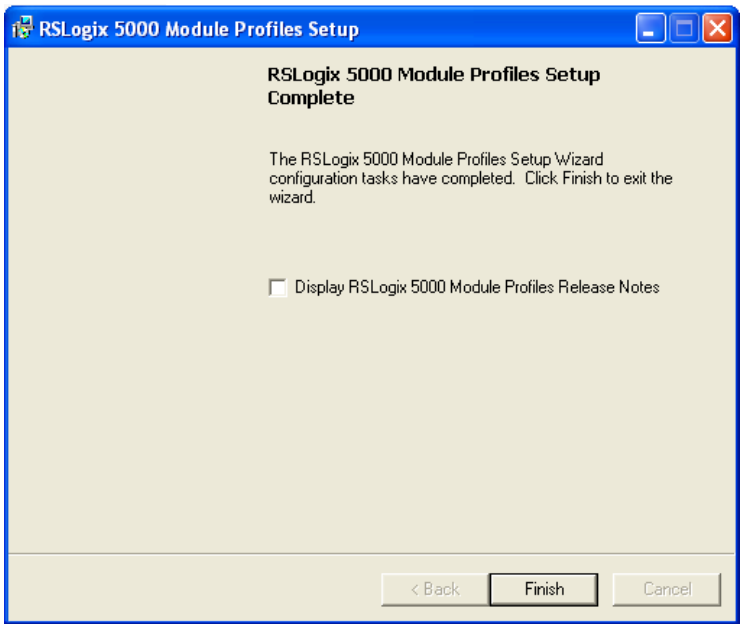
Run the **MPSetup.exe** file to start the Setup Wizard. Follow the Setup Wizard to properly install the AOP.


RSLogix 5000 Module Profiles Setup
Welcome to the RSLogix 5000 Module Profiles Setup Wizard.
The RSLogix 5000 Module Profiles Setup Wizard provides for the installation of these groups of RSLogix 5000 Module Profiles.
Prosoft Technology 1769 Comm Module Profiles
1.05.1
Details...
< Back
Next >
Cancel

Continue to follow the steps in the wizard to complete the installation.

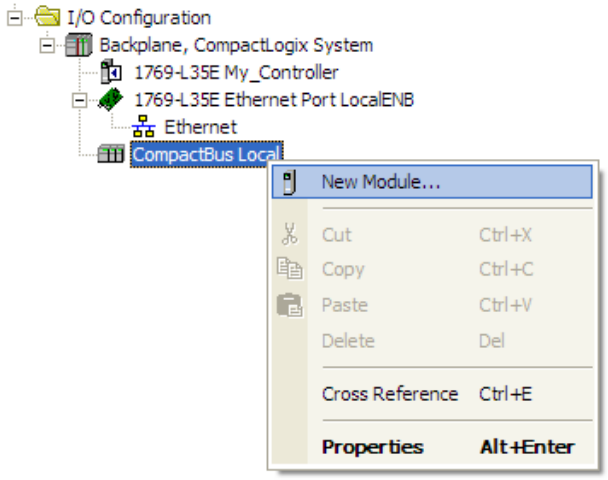


Click **Finish** when complete**.** The AOP is now installed in RSLogix 5000. There is no need to reboot the PC.

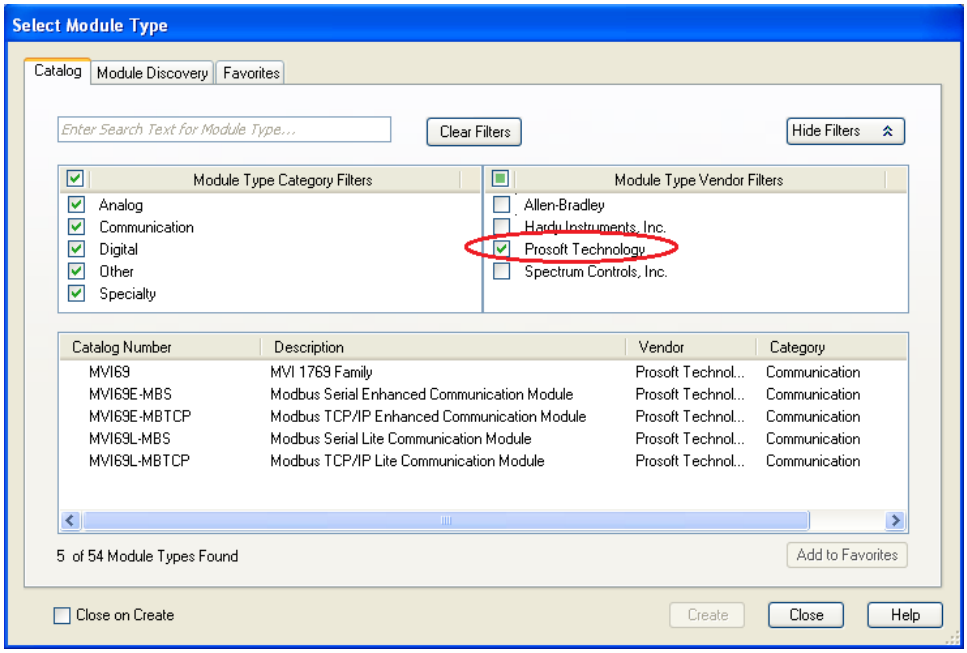

RSLogix 5000 Module Profiles Setup
RSLogix 5000 Module Profiles Setup Complete
The RSLogix 5000 Module Profiles Setup Wizard configuration tasks have completed. Click Finish to exit the wizard.
Display RSLogix 5000 Module Profiles Release Notes
< Back
Finish
Cancel

2.4.2 Creating a Module in the Project Using an Add-On Profile

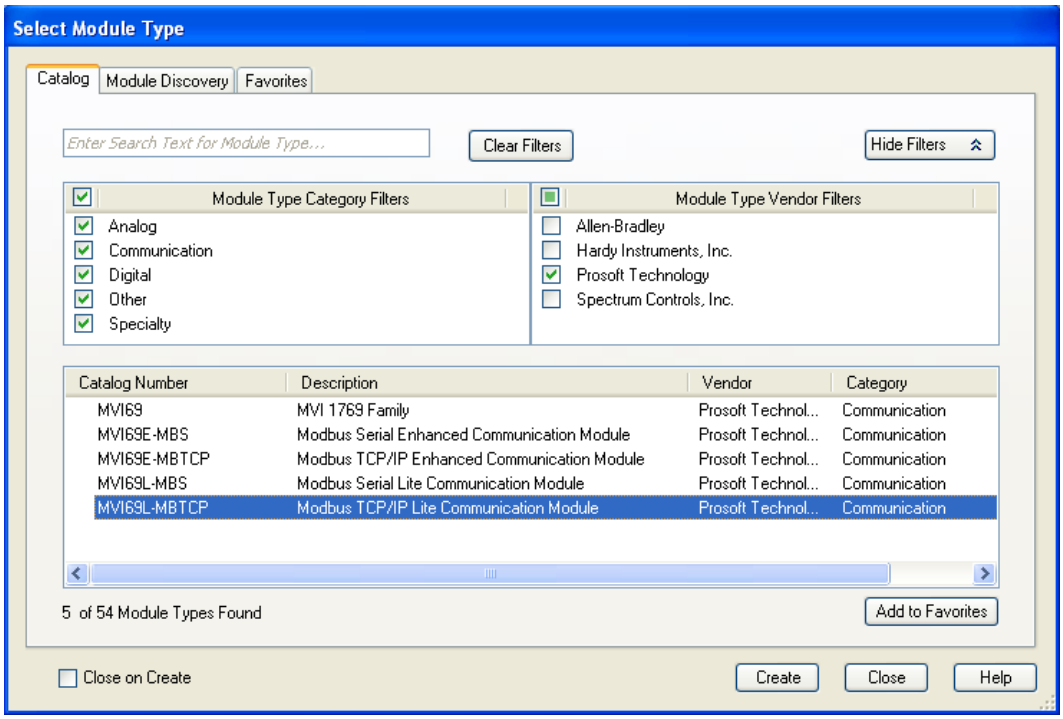
1 In RSLogix 5000, expand the **I/O CONFIGURATION** folder in the Project tree. Right-click the appropriate communications bus and select **NEW MODULE** from the shortcut menu.



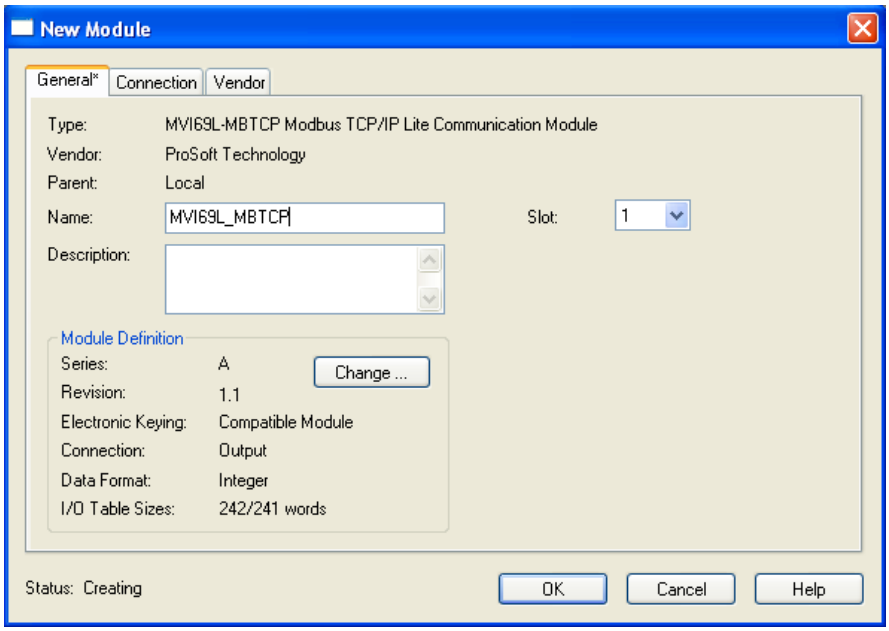
This action opens the *Select Module Type* dialog box. In the *Module Type Vendor Filters* area, uncheck all boxes except the **ProSoft Technology** box. A list of ProSoft Technology modules will appear below.



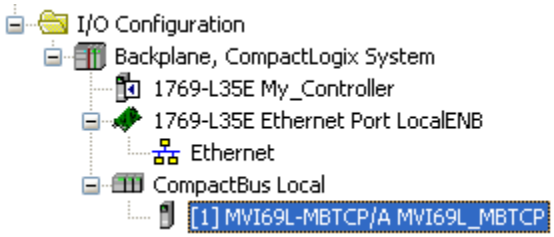
2 Select the MVI69L-MBTCP module in the list and click **Create**:



3 A *New Module* dialog box will open. Edit the **Name** and **Slot** of the module and click **OK.**



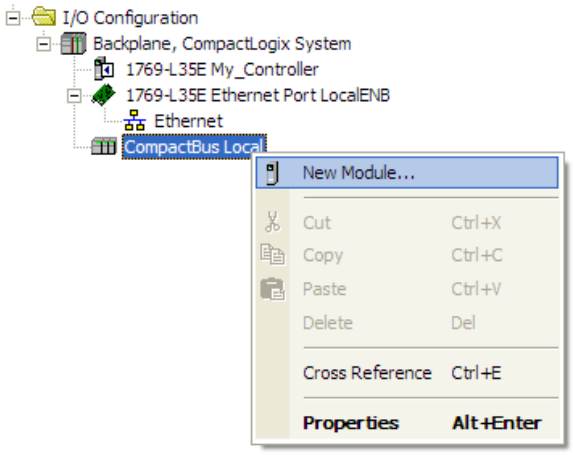
The MVI69L-MBTCP module will now be visible at the I/O Configuration tree.



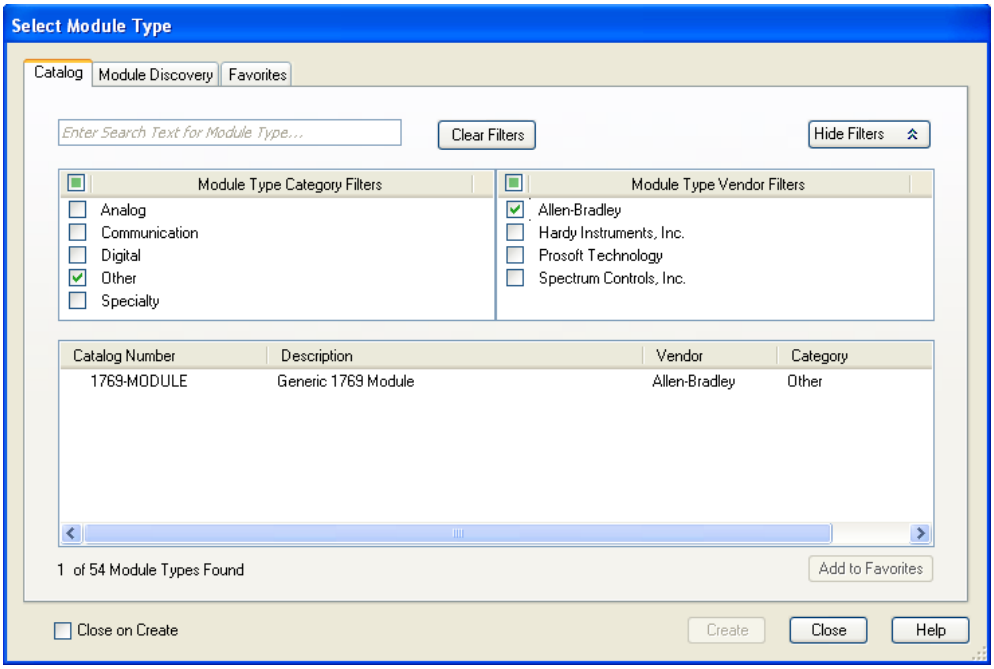
2.4.3 Creating a Module in the Project Using a Generic 1769 Module Profile

Note: This procedure is not required if the ProSoft Technology AOP is installed.

1 Expand the **I/O CONFIGURATION** folder in the Project tree. Right-click the appropriate communications bus and select **NEW MODULE**.



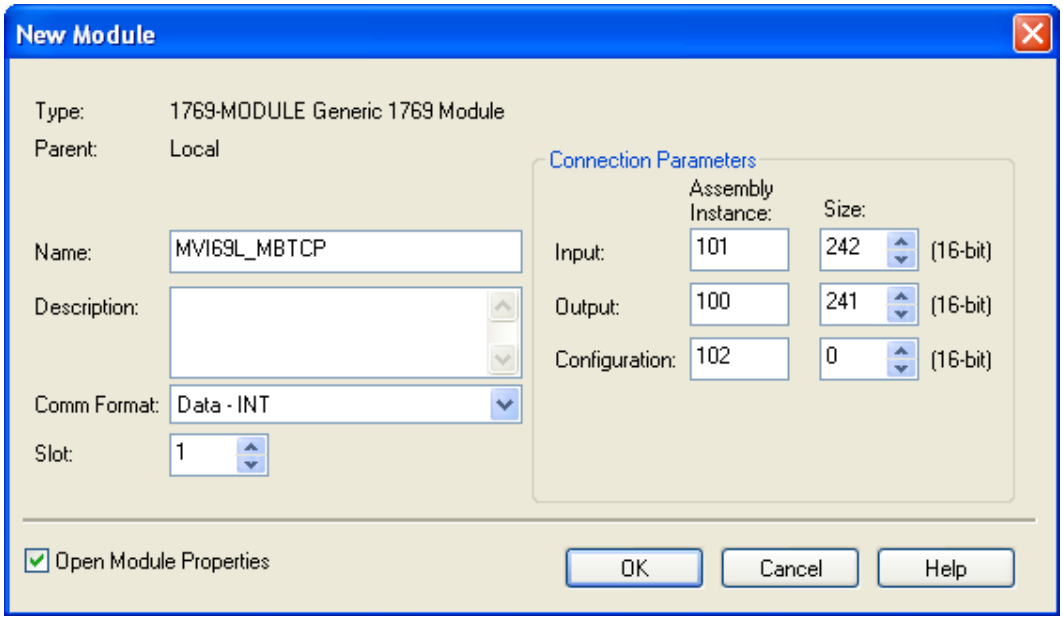
This action opens the *Select Module Type* dialog box. Enter **generic** in the search text box and select the **GENERIC 1769 MODULE**. If you're using an earlier version of RSLogix, expand **OTHER** in the *Select Module* dialog box, and then select the **GENERIC 1769 MODULE**.



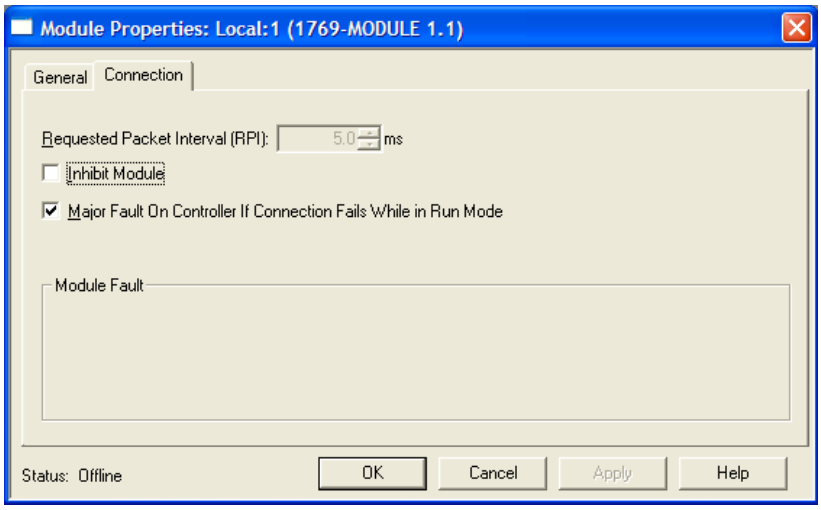
2 Set the Module Properties values as follows:

Parameter	Value
Name	Enter a module identification string. Example: MVI69L_MBTCP
Description	Enter a description for the module. Example: ProSoft communication module for Serial Modbus communications.
Comm Format	Select **Data-INT**
Slot	Enter the slot number in the rack where the MV69L-MBTCP module will be installed.
Input Assembly Instance	101
Input Size	242
Output Assembly Instance	100
Output Size	241
Configuration Assembly Instance	102
Configuration Size	0

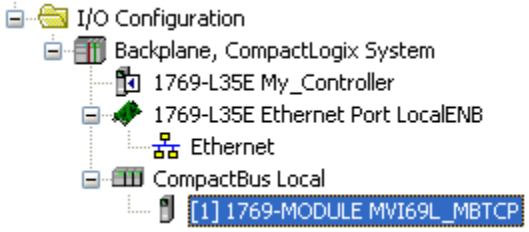
This module must be configured with a block transfer size of 240 words (input block size = 242 words, output block size = 241 words):



3 On the *Connection* tab, set the RPI value for your project. Click **OK** to confirm.



The MVI69L-MBTCP module will be visible at the I/O Configuration tree.



2.5 Importing the Add-On Instruction

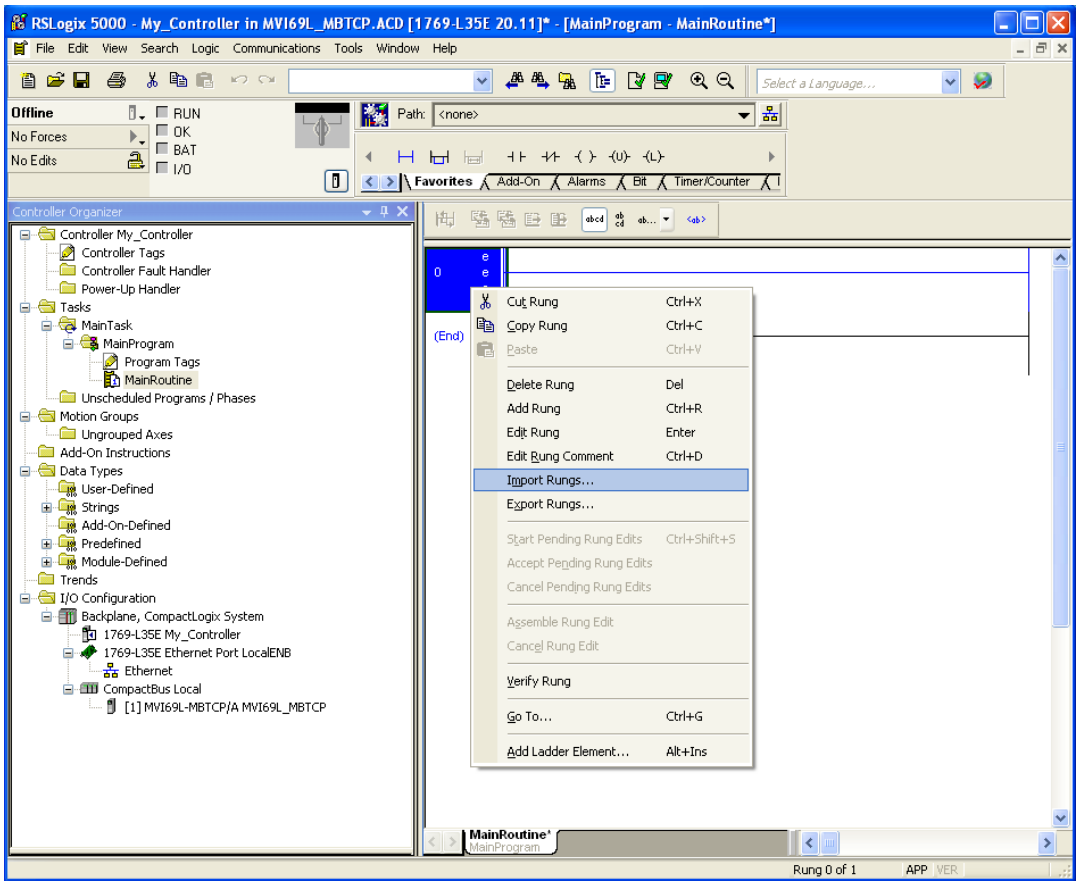
1 Open the application in RSLogix 5000.

2 Expand the **TASKS** folder, and expand the **MAINTASK** folder.

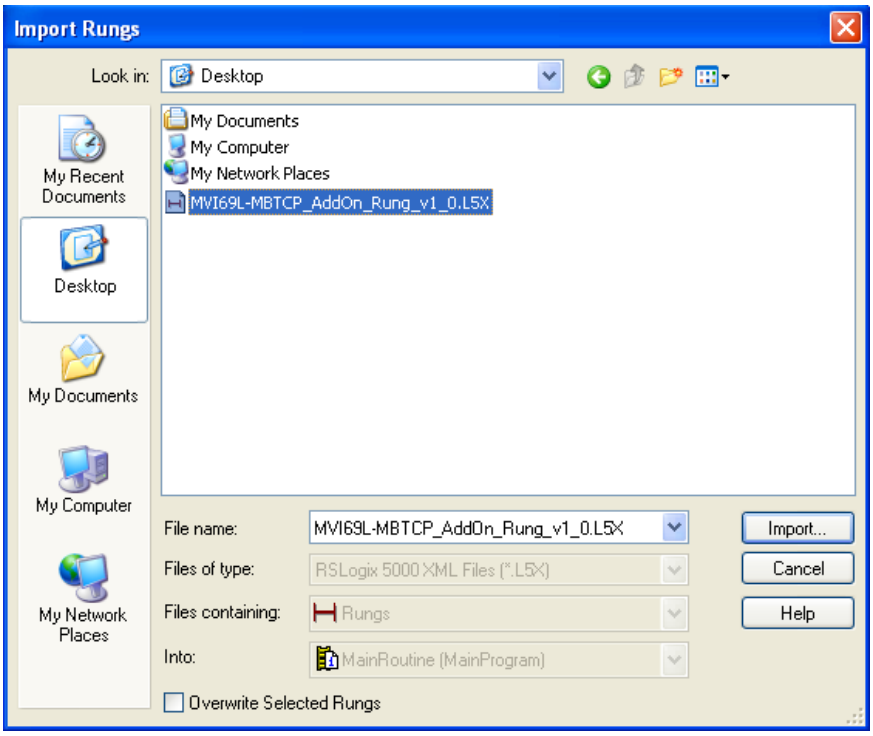
3 Expand the **MAINPROGRAM** folder. The **MAINROUTINE** contains rungs of logic. The very last rung in this routine will be blank. This is where the AOI can be imported.

Note: The Add-On Instruction can be placed in a different routine than the MainRoutine. Make sure to add a rung with a jump instruction (JSR) in the MainRoutine to jump to the routine containing the Add-On Instruction.

4 Select an empty rung in the routine. Right-click the rung and select **IMPORT RUNGS** from the shortcut menu.

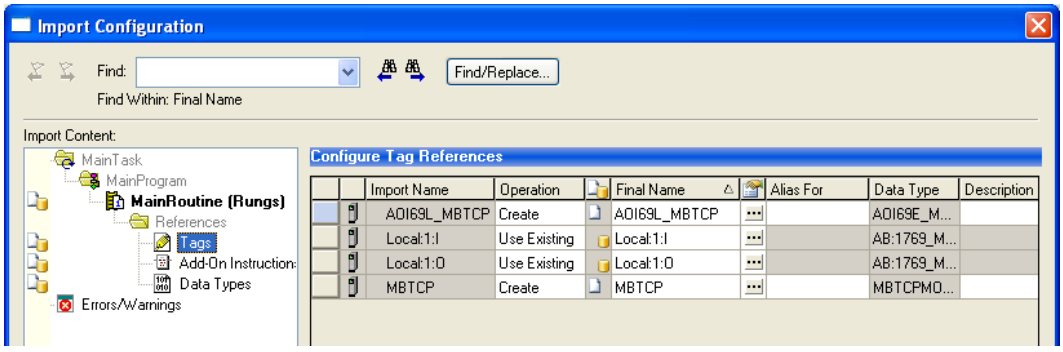


5 Select the .L5X file that was exported from PCB earlier.



This action opens the *Import Configuration* dialog box. Click **TAGS** under **MAINROUTINE** to display the controller tags that will be created.

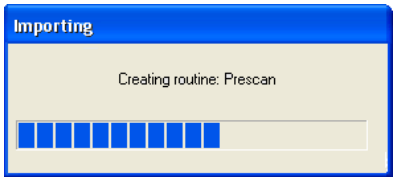
Note: If you are using RSLogix version 16 or earlier, the *Import Configuration* dialog box will not contain the *Import Content* tree.



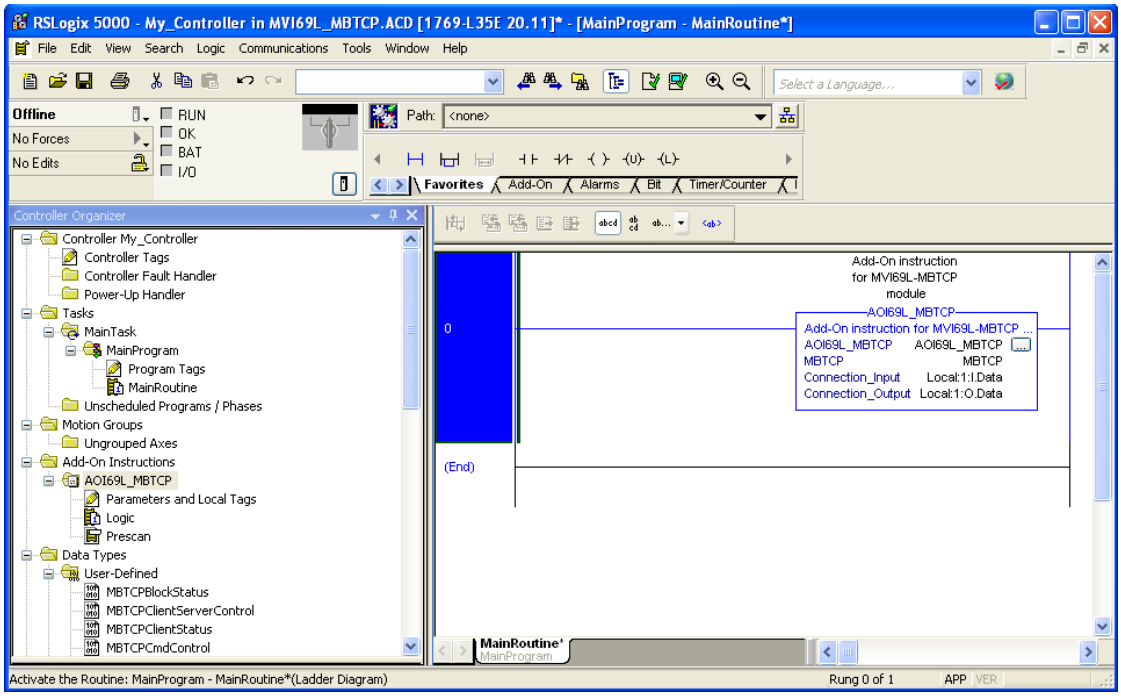
6 If the module is not located in the default slot (or is in a remote rack), edit the connection input and output variables that define the path to the module in the **FINAL NAME** column (**NAME** column for RSLogix version 16 or less). For example, if your module is located in slot 3, change *Local:1:I* in the **FINAL NAME** column to *Local:3:I.* Do the same for *Local:1:O*.

Note: If your module is located in Slot 1 of the local rack, this step is not required.

7 Click **OK** to confirm the import. RSLogix will indicate that the import is in progress:



When the import is completed, the new rung with the Add-On instruction will be visible as shown in the following illustration.



The procedure has also imported new user defined data types, data objects and the Add-On instruction to be used in the project.

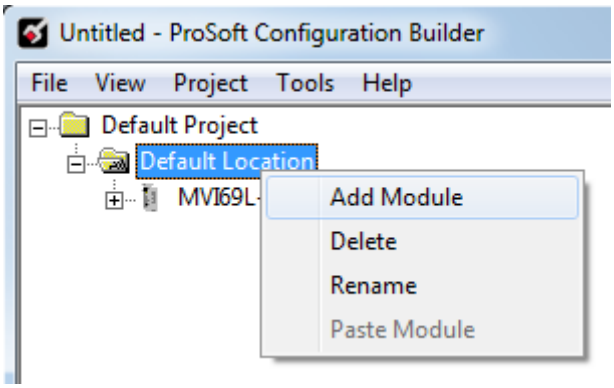
2.6 Adding Multiple Modules in the Rack (Optional)

Important: This procedure is for multiple MVI69L-MBTCP modules running in the same CompactLogix rack.

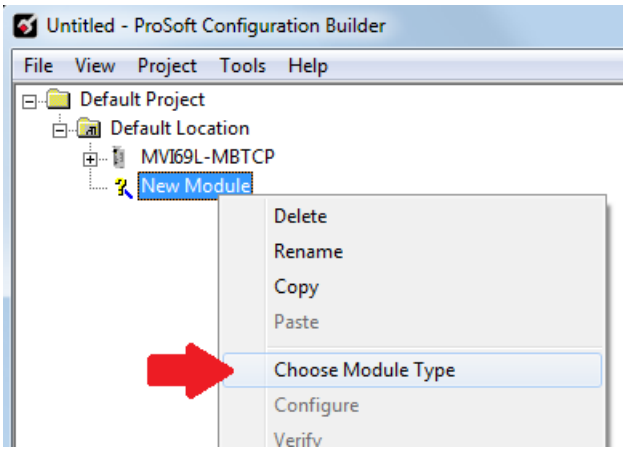
You must export a new Add-On Instruction from PCB for each module. You do this by adding a new module to the PCB project and exporting the module configuration as an L5X file. Finally, import the new .L5X file into RSLogix 5000 for the new module.

2.6.1 Adding a New Module in PCB

1 Right click on **Default Location** (which you can rename) and select **Add Module**.

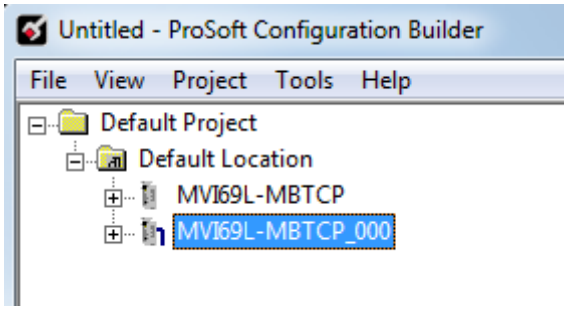


2 Right-click or double-click to open the **Choose Module Type** window.

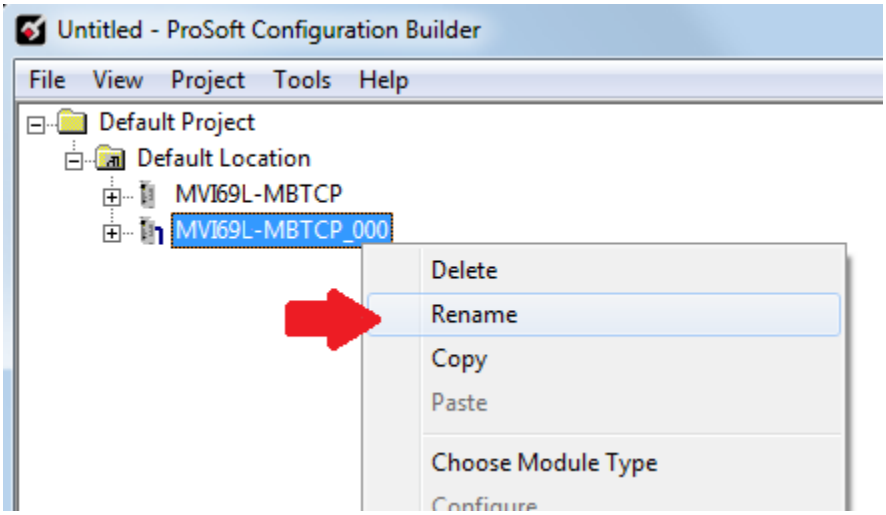


3 Select the **MVI69L-MBTCP** module to add a second (or more) module in the PCB project.

Note: A duplicate MVI69L-MBTCP module requires a unique name. The default name on a duplicate module appends a number to the end such as **MVI69L-MBTCP_000**, **MVI69L-MBTCP_001**, etc.



4 You can rename the module by right clicking the module and selecting **Rename**.

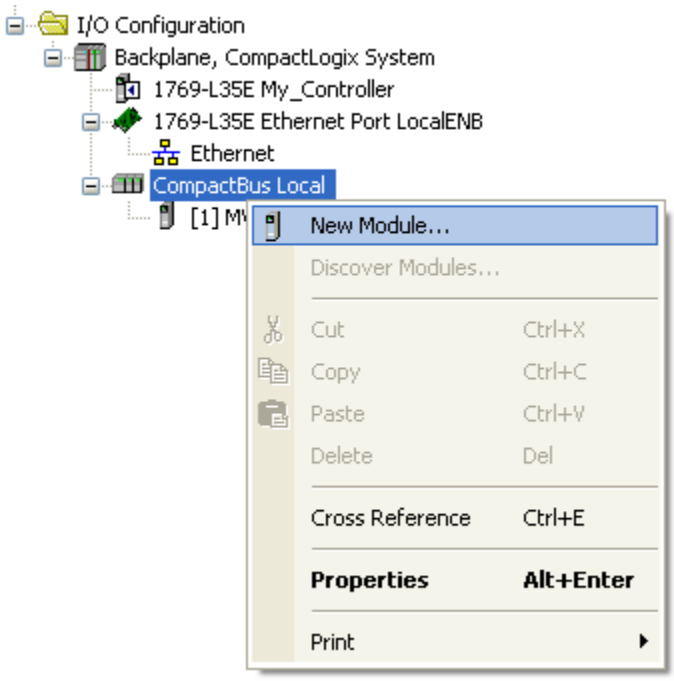


5 Configure the proper parameters in PCB as described before on page 22 and export the AOI .L5X file.

2.6.2 Adding a new module in RSLogix 5000

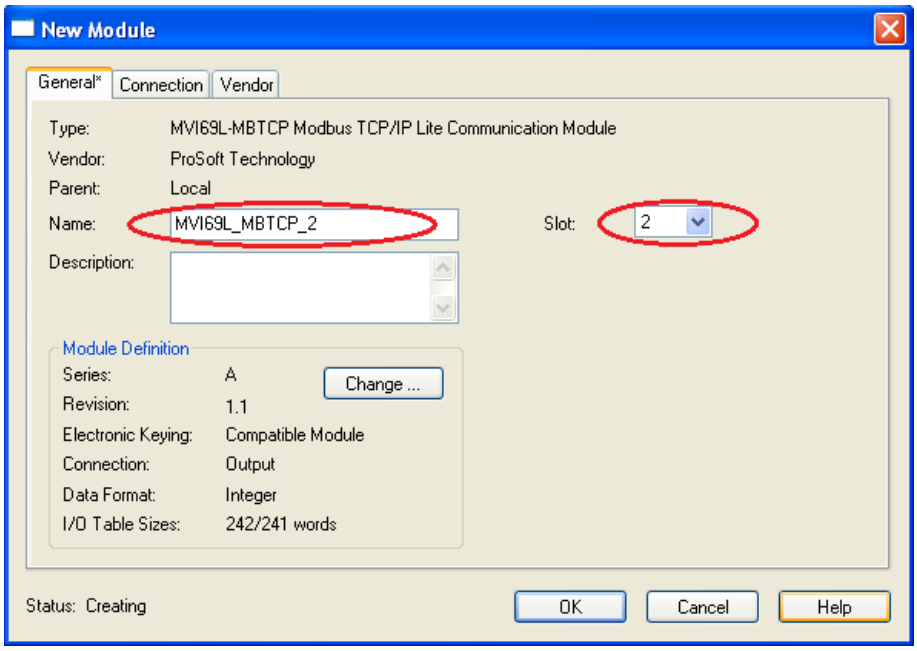
Multiple modules can be placed in the same rack provided it does not exceed the power distance rating of the CompactLogix rack (see page 10). Adding an additional module to the rack is similar to installing a new module earlier in this chapter. However, the name of the module must be unique.

1 In RSLogix 5000, locate the **I/O CONFIGURATION** folder. Right click to open a shortcut menu and choose **NEW MODULE**.

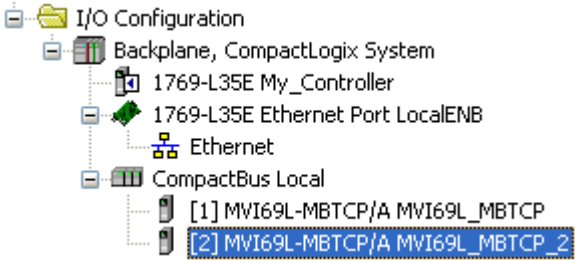


2 In the **SELECT MODULE TYPE** window, select the MVI69L-MBS module as when installing the first module using the AOP. If using an AOP is not an option, select **GENERIC 1769 MODULE** and click *Create*.

3 The **NEW MODULE** window will appear. Enter a unique name for the new module. Also confirm the slot number of the new module.

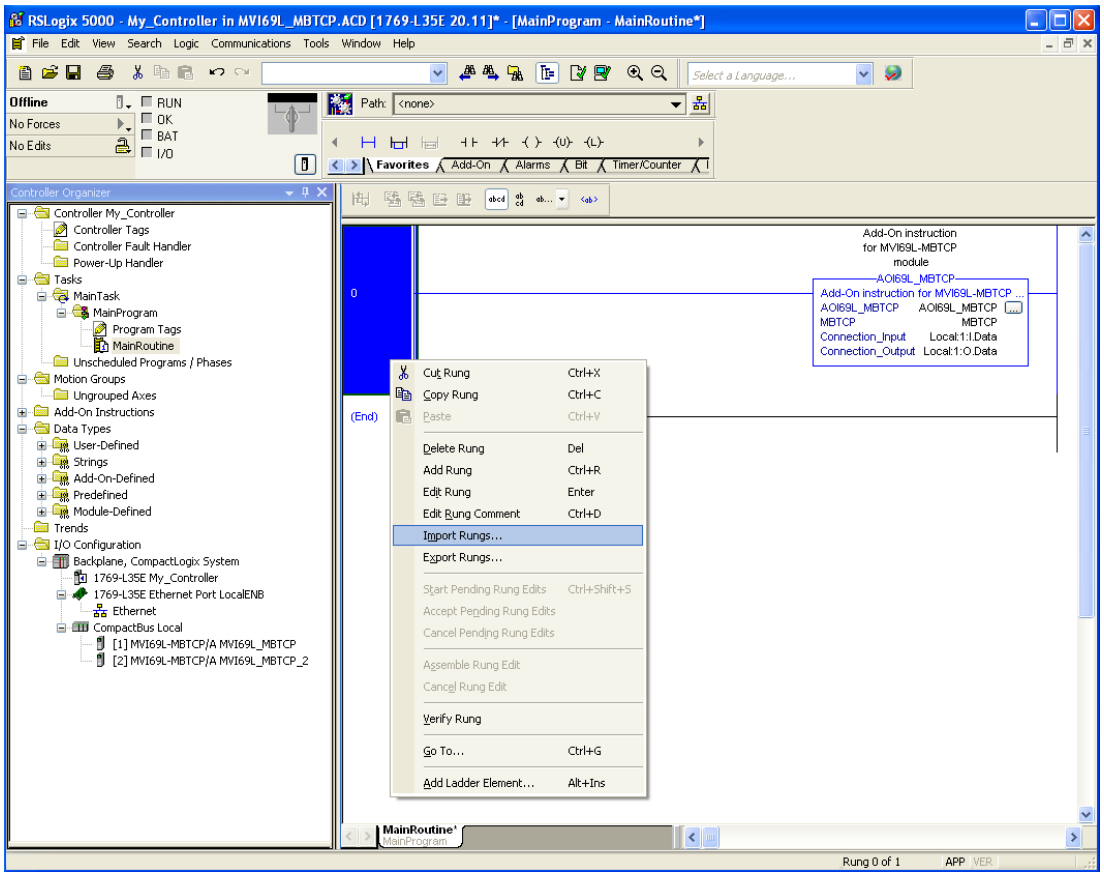


4 Click **OK** to confirm. The new module is now visible:

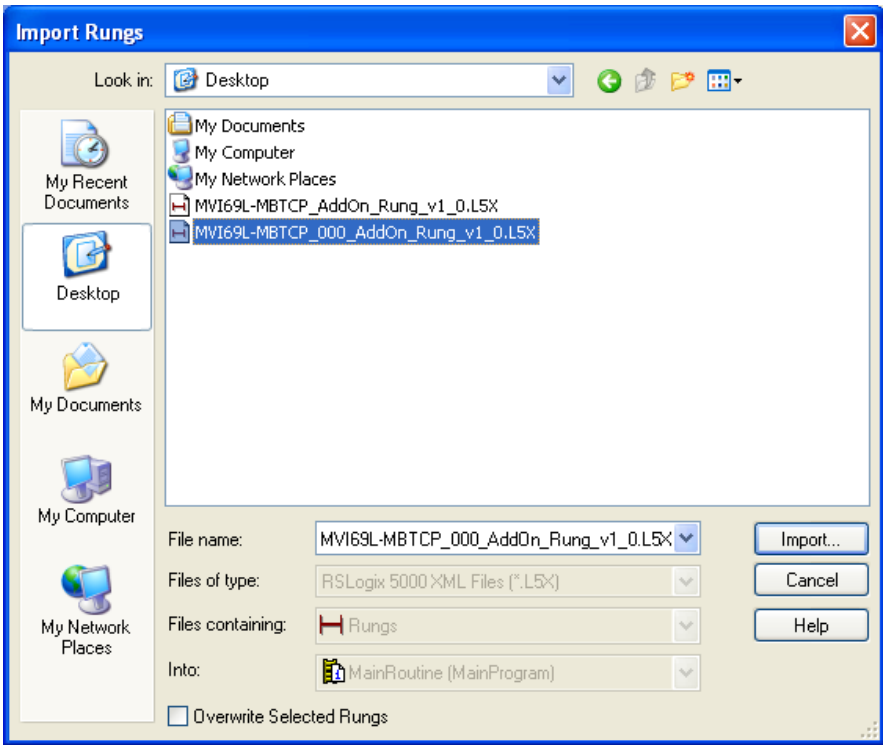


5 Importing the AOI for the new module is also required. In the *Controller Organizer* pane, double-click and open the **MAINROUTINE** ladder.

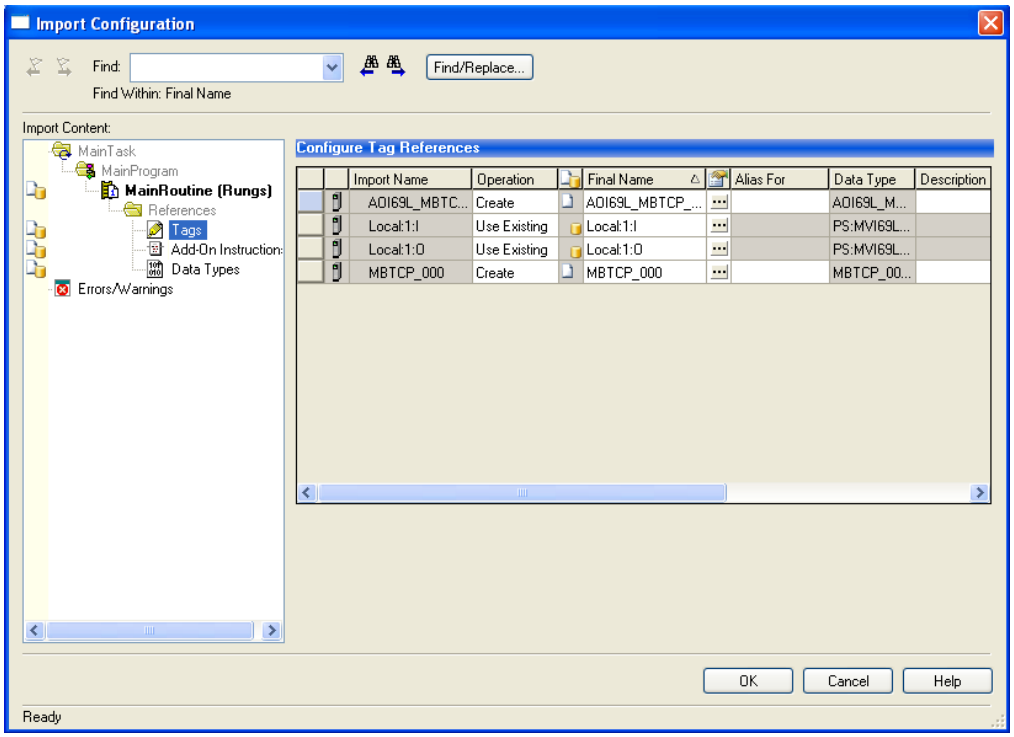
6 Select an empty rung in the routine, and then click the right mouse button to open a shortcut menu. On the shortcut menu, choose **IMPORT RUNGS…**



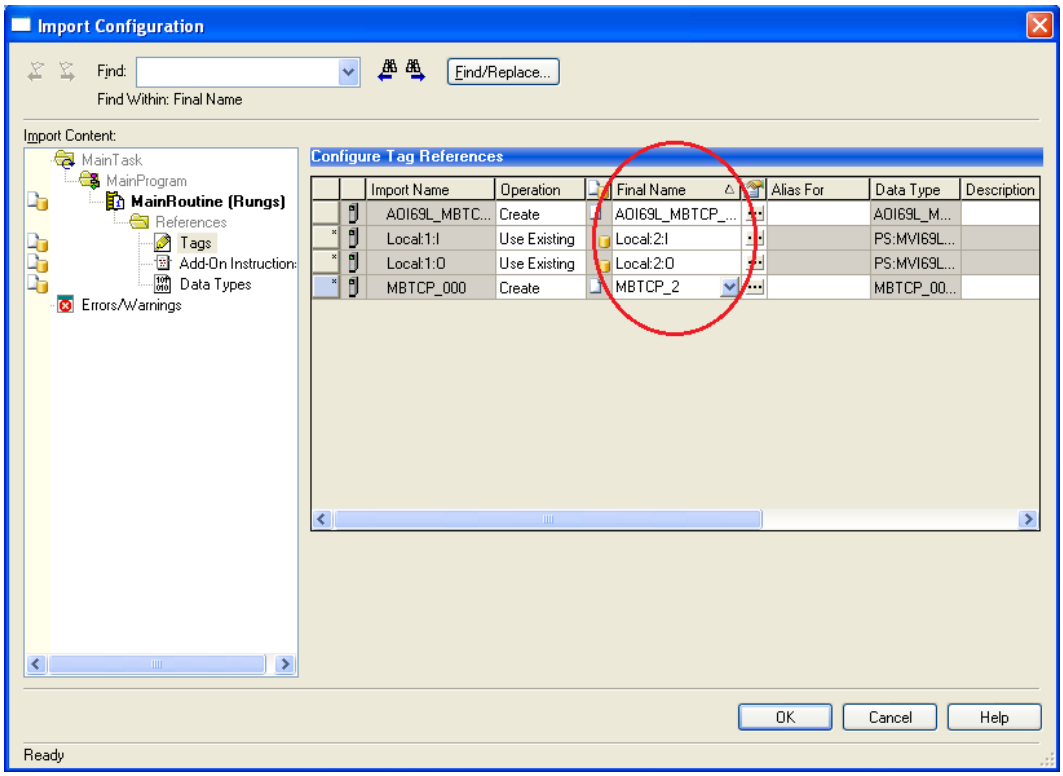
7 Select the .L5X file of the new module, and click **IMPORT.** The new .L5X file will have a unique filename.



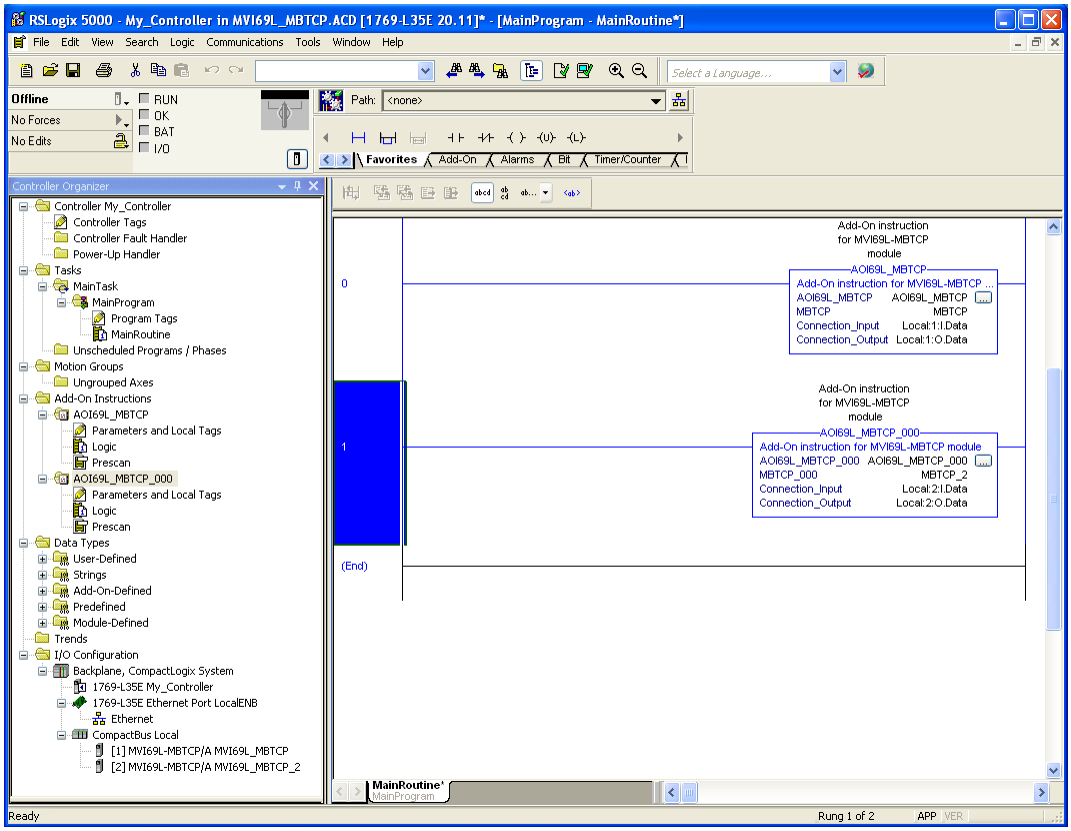
8 This action opens the **IMPORT CONFIGURATION** window, showing the tags to be imported. You must edit the *Final Name* column of the tags for the second module.



9 Associate the I/O connection variables to the correct module in the corresponding slot number. The default values are Local:1:I and Local:1:O. You must edit these values if the card is placed in a slot location other than slot 1 (Local:1:x means the card is located in slot 1). Since the second card is placed in slot 2, change the *Final Name* to Local:2:I and Local:2:O. Also, you can append a '_2' at the end of the *Final Name* of 'AOI69_MBTCP' and 'MBTCP' arrays as shown below.



10 Click **OK** to confirm.



The setup procedure is now complete. Save the project, it is ready to download to the CompactLogix processor.

3 MVI69L-MBTCP Configuration

In This Chapter

- Basic PCB Functions 46
- Module Configuration Parameters 49
- Downloading the Configuration File to the Processor 60

ProSoft Configuration Builder software provides a quick and easy way to manage module configuration files customized to meet the application needs.

The module's configuration is built and edited in ProSoft Configuration Builder (PCB). PCB is used to download the configuration file to the CompactLogix processor, where it is stored in the *MBTCP.CONFIG* controller tag generated by the previously exported AOI. When the MVI69L-MBTCP module boots up, it requests the processor to send it the configuration over the backplane in special Configuration Blocks.

Chapter 2 contains the procedures for creating a new PCB project and exporting a .L5X file for the processor. Chapter 3 offers more insight into using PCB. It will describe the configuration parameters in detail, as well as how to download the configuration to the processor.

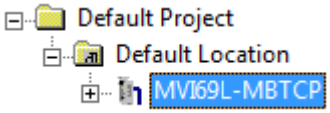
3.1 Basic PCB Functions

3.1.1 Creating a New PCB Project and Exporting an .L5X File

Please see Chapter 2.

3.1.2 Renaming PCB Objects

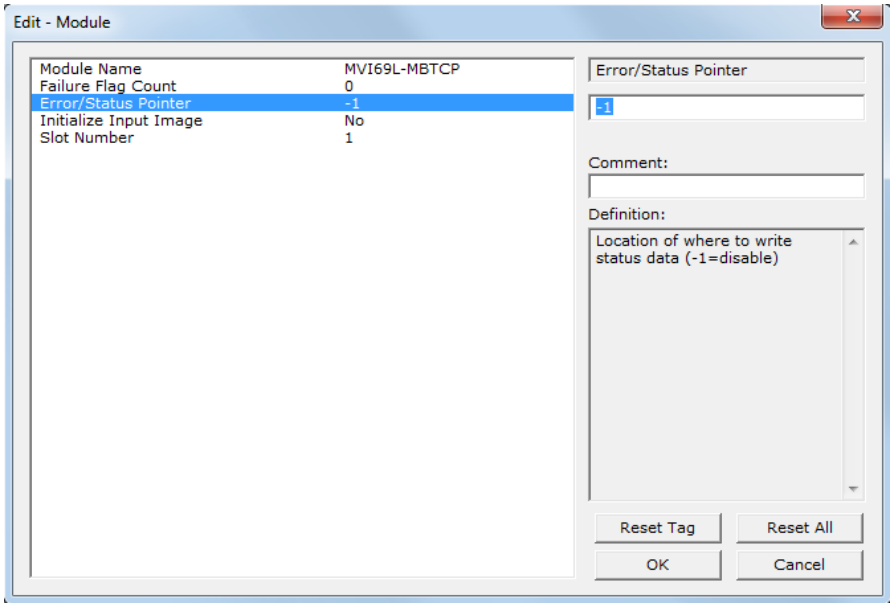
PCB objects such as the *Default Project* and *Default Location* folders as well as the *Module* icon can be renamed to customize the project.



1. Right-click the object to be renamed, and select **RENAME** from the shortcut menu.
2. Type the name to assign to the object.
3. Click *away* from the object to save the new name.

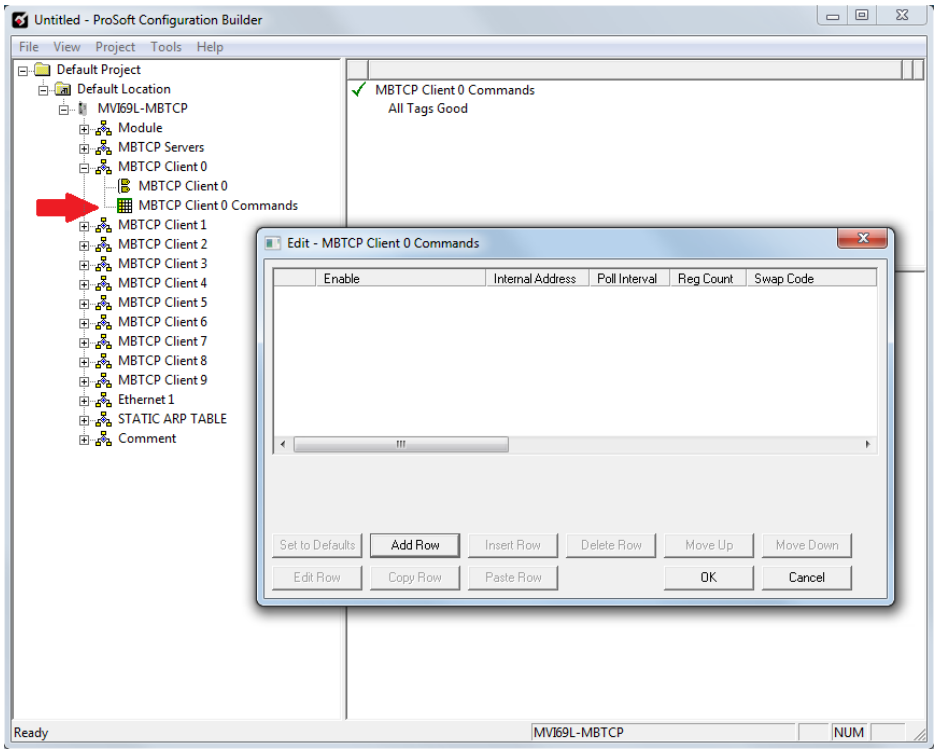
3.1.3 Editing Configuration Parameters

1. Click on the **[+]** sign next to the **MODULE** icon to expand module information.
2. Click on the **[+]** sign next to any icon to view module information and configuration options.
3. Double-click any icon to open an *Edit* dialog box.
   To edit a parameter, highlight the parameter name in the left pane and edit the field in the right pane.

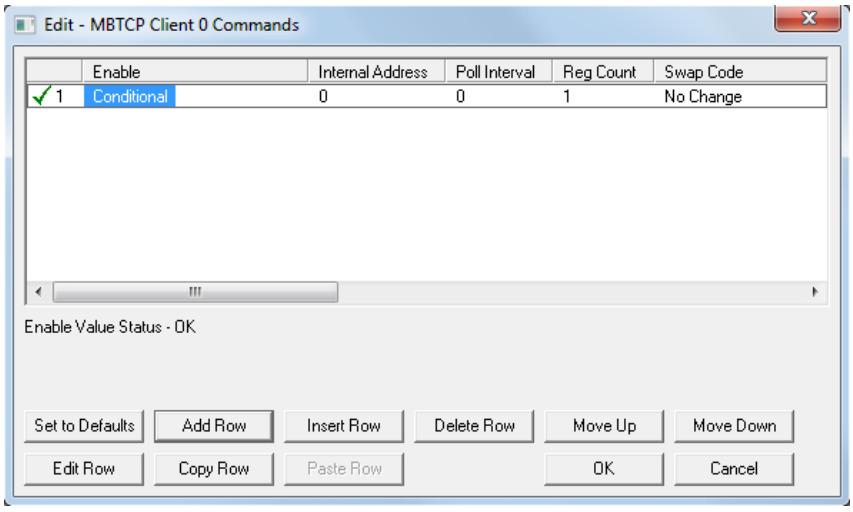


Note: Depending on the parameter, the editable field will accept typed input in the form of text or a valid numerical value, or it will have a dropdown list with options to choose from.

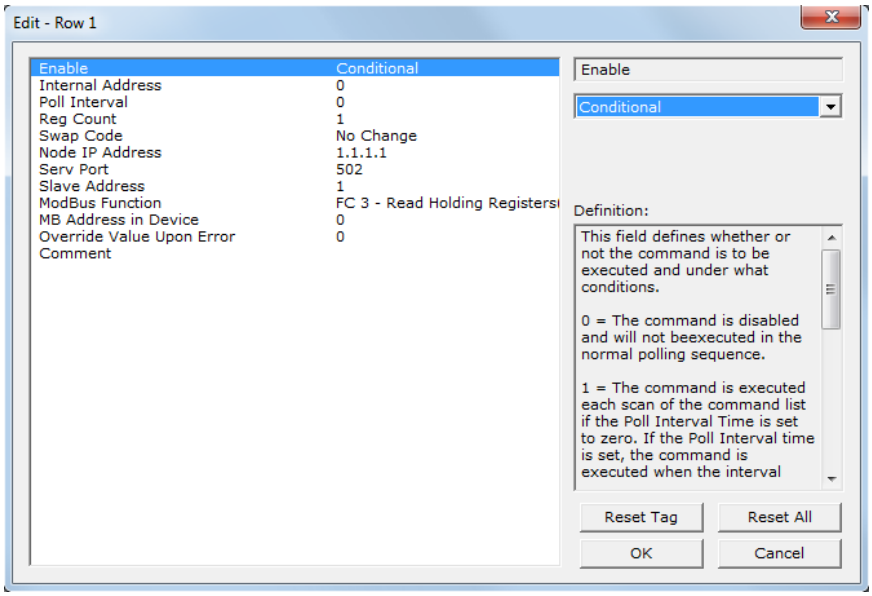
4 Double-clicking any icon will open an *Edit* dialog box with a table. This dialog box is used to build and edit Modbus Client commands.



To add a row to the table, click the **ADD ROW** button.



To edit the row, click the **EDIT ROW** button. This will open an *Edit* dialog box.



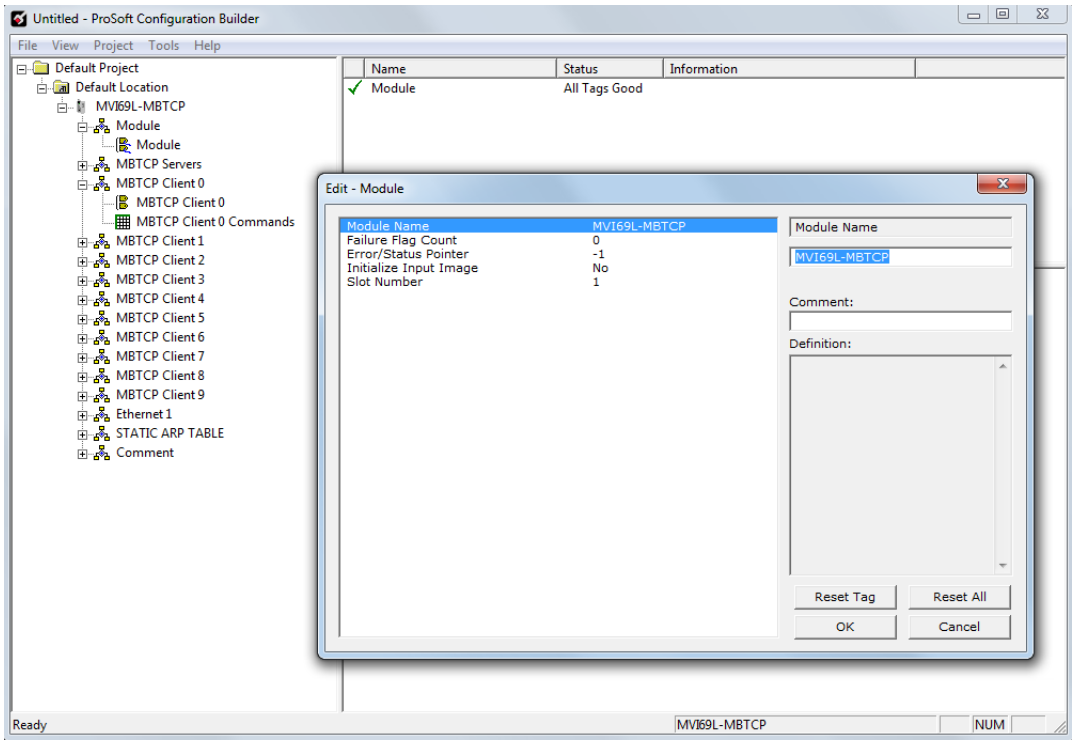
3.1.4 Printing a Configuration File

1. In the main PCB window, right-click the **MODULE** icon and select **VIEW CONFIGURATION** from the shortcut menu. This action opens the *View Configuration* window.
2. In the *View Configuration* window, open the **FILE** menu, and choose **PRINT.** This action opens the *Print* dialog box.
3. In the *Print* dialog box, choose the printer to use from the drop-down list, select printing options, and then click **OK.**

3.2 Module Configuration Parameters

3.2.1 Module

This section contains general module configuration parameters, including database allocation and backplane transfer options.

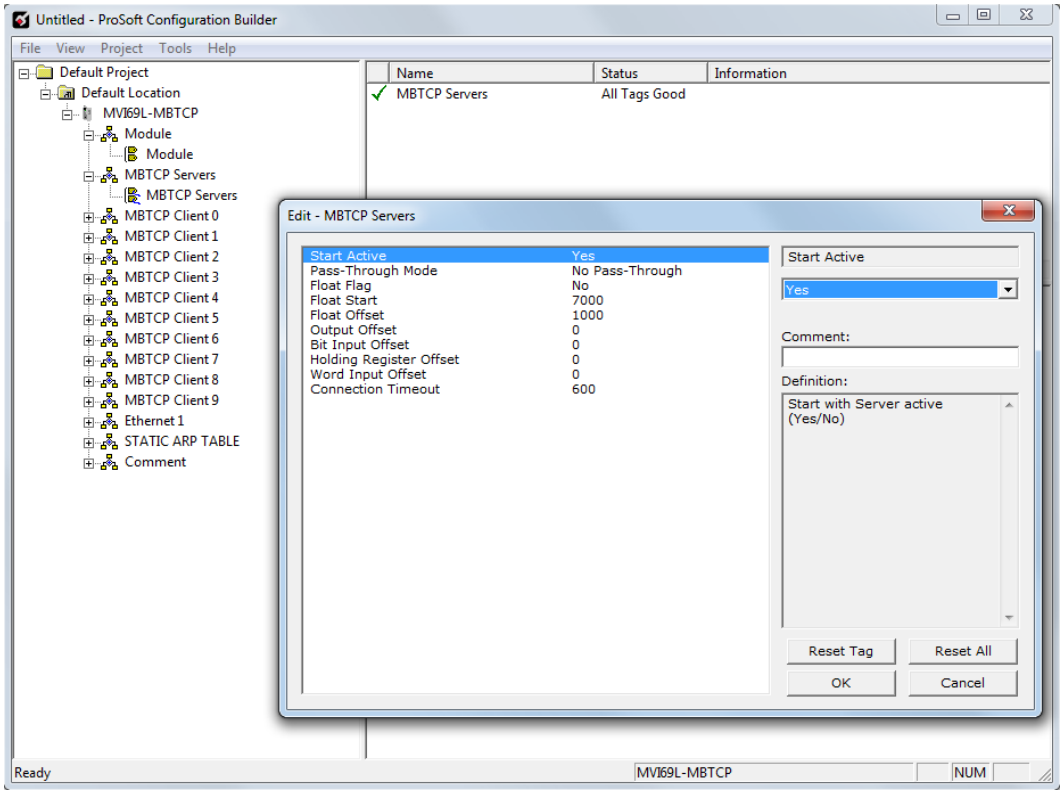


Parameter	Value	Description
Module Name	ASCII characters (max. 80)	Assigns a name to the module that can be viewed using the configuration/debug port. Use this parameter to identify the module and the configuration file.
Failure Flag Count	0 to 65535	Specifies the number of consecutive backplane transfer failures that can occur before Modbus communications should be halted.
Error/Status Pointer	-1 to 239	Starting register location in virtual Modbus database for the error/status table. If a value of -1 is entered, the error/status data will not be placed in the database. All other valid values determine the starting location of the data. This data area includes the module version information and all server error/status data. Refer to General Status (page 88) for more information.
Initialize Input Image	Yes or No	This parameter is used to determine if the input image data, the module's Read Register Data values, should be initialized with Read Register Data values from the processor. If the value is set to No, the Read Register Data values in the module will be set to 0 upon

		initialization. If the value is set to Yes, the data will be initialized with Read Register Data values from the processor. Use of this option requires associated ladder logic to pass the data from the processor to the module.
Slot Number	1 to x	Represents the slot in the CompactLogix rack where the module resides.

3.2.2 MBTCP Servers

This section applies to configuring the MVI69L-MBTCP Server (slave) Driver.

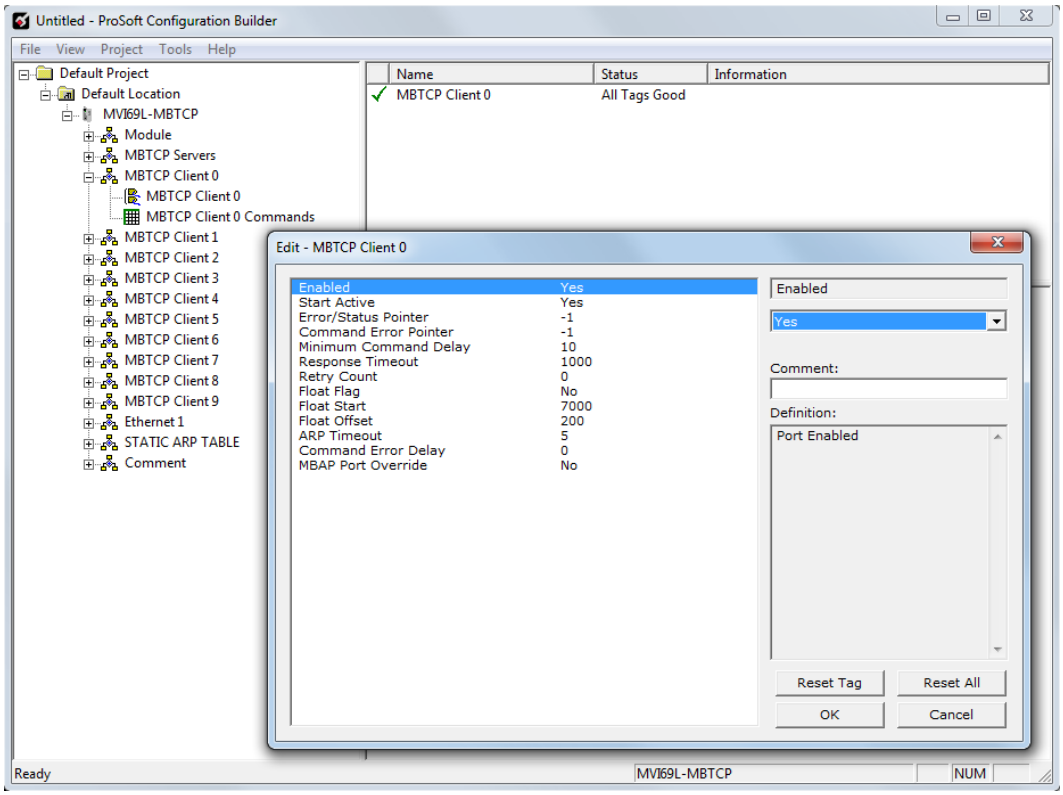


Parameter	Value	Description
Start Active	Yes or No	Specifies whether or not the port and commands will be active upon module boot-up.
Pass-Through Mode	Client, Server, or Server with Pass-Through	This parameter specifies which device type the port will emulate. Refer to page 72 for more information on the Server with Pass-Through option.
Float Flag	Yes or No	Specifies how the Server driver will respond to Function Code 3, 6, and 16 commands (read and write Holding Registers) from a remote Client when it is moving 32-bit floating-point data.

		If the remote Client expects to receive or will send one complete 32-bit floating-point value for each count of one (1), then set this parameter to **YES**. When set to **YES**, the Server driver will return values from two consecutive 16-bit internal memory registers (32 total bits) for each count in the read command, or receive 32-bits per count from the Client for write commands. Example: Count = **10**, Server driver will send 20 16-bit registers for 10 total 32-bit floating-point values. If, however, the remote Client sends a count of two (2) for each 32-bit floating-point value it expects to receive or send, or, if you do not plan to use floating-point data in your application, then set this parameter to **NO**, which is the default setting. You will also need to set the *Float Start* and *Float Offset* parameters to appropriate values whenever the *Float Flag* parameter is set to **YES**.
Float Start	0 to 479	Defines the first register of floating-point data. All requests with register values greater-than or equal to this value is considered floating-point data requests. This parameter is only used if the Float Flag is enabled. For example, if a value of 200 is entered, all requests for registers 200 and above is considered as floating-point data.
Float Offset	0 to 479	Defines the start register for floating-point data in the internal database. This parameter is used only if the Float Flag is enabled. For example, if the Float Offset value is set to 100 and the float start parameter is set to 200, data requests for register 200 uses the internal Modbus register 100.
Output Offset	0 to 479	Specifies the offset address into the internal Modbus database for network requests for Modbus function 1, 5 or 15 commands. For example, if the value is set to 100, an address request of 0 corresponds to register 100 in the database.
Bit Input Offset	0 to 479	Specifies the offset address into the internal Modbus database for network requests for Modbus function 2 commands. For example, if the value is set to 150, an address request of 0 returns the value at register 150 in the database.
Holding Register Offset	0 to 479	Specifies the offset address in the internal Modbus database for network requests for Modbus function 3, 6, or 16 commands. For example, if a value of 250 is entered, a request for address 0 corresponds to the register 250 in the database.
Word Input Offset	240 to 479	Specifies the offset address into the internal Modbus database for network requests for Modbus function 4 commands. For example, if the value is set to 350, an address request of 0 returns the value at register 350 in the database.
Connection Timeout	0 to 1200	Specifies the Server's timeout period if it is not receiving any new data in the amount of seconds preset.

3.2.3 MBTCP Client x

This section defines the general configuration for MBTCP Client x. Up to 10 MBTCP Clients can be configured, each using the parameters below.



Parameter	Value	Description
Enabled	Yes or No	Enables this client
Start Active	Yes or No	Specifies whether to start with commands active on boot up
Error/Status Pointer	-1 to 239	Specifies the starting register location in the module's database for the error/status table for this client. If a value of -1 is entered, the error/status data will not be placed in the database. All other valid values determine the starting location of the data. This data should be placed within the read data range of module memory.
Command Error Pointer	-1 to 239	Specifies the address in the module's database where the command error data will be placed. If the value is set to -1, the data will not be transferred to the database. This data should be placed within the read data range of module memory.
Minimum Command Delay	0 to 65535 milliseconds	Specifies the number of milliseconds to wait between receiving the end of a server's response to the most recently transmitted command and the issuance of the next

		command. This parameter can be used to place a delay after each command to avoid sending commands on the network faster than the servers can be ready to receive them. It does not affect retries of a command, as retries will be issued when a command failure is recognized.
Response Timeout	1 to 65535 milliseconds	Specifies the command response timeout period in 1 millisecond increments. The Client will wait for a response from the addressed server within the timeout period before re-transmitting the command (Retries) or skipping to the next command in the Command List. The value to specify depends on the communication network used and the expected response time (plus or minus) of the slowest device on the network.
Retry Count	0 to 10	Specifies the number of times a command will be retried if it fails.
Float Flag	Yes or No	Specifies how the Slave driver responds to Function Code 3, 6, and 16 commands (read and write Holding Registers) from a remote Master when it is moving 32-bit floating-point data. Note: Most applications using floating-point data do not need this parameter enabled. If the remote Master expects to receive or sends one complete 32-bit floating-point value for each count of one (1), then set this parameter to **YES**. When set to **YES**, the Slave driver returns values from two consecutive 16-bit internal memory registers (32 total bits) for each count in the read command, or receive 32-bits per count from the Master for write commands. Example: Count = **10**, Slave driver sends 20 16-bit registers for 10 total 32-bit floating-point values. If, however, the remote Master sends a count of two (2) for each 32-bit floating-point value it expects to receive or send, or, if you do not plan to use floating-point data in your application, then set this parameter to **No**, which is the default setting. You also need to set the *Float Start* and *Float Offset* parameters to appropriate values whenever the *Float Flag* parameter is set to **YES**.
Float Start	0 to 479	Defines the first register of floating-point data. All requests with register values greater-than or equal to this value is considered floating-point data requests. This parameter is only used if the Float Flag is enabled. For example, if a value of 200 is entered, all requests for registers 200 and above is considered as floating-point data.
Float Offset	0 to 479	Defines the start register for floating-point data in the internal database. This parameter is used only if the Float Flag is enabled. For example, if the Float Offset value is set to 100 and the float start parameter is set to 200, data requests for register 200 uses the internal Modbus register 100.
ARP Timeout	1 to 60 seconds	Specifies the number of seconds to wait for an ARP reply after a request is issued. If the value is out of range, the

		default value of 5 will be utilized.
Command Error Delay	0 to 300	Specifies the number of 100 millisecond intervals to turn off a command in the error list after an error is recognized for the command. If this parameter is set to 0, there will be no delay.
MBAP Port Override	Yes or No	Override default port settings. 'No' = Standard Server Port 502 with MBAP format messages will be used. All other Server Port values use encapsulated Modbus message format (RTU via TCP). 'Yes' = MBAP format messages are used for all Server Port values. RTU via TCP will not be used.

3.2.4 MBTCP Client x Commands

In order to interface the MVI69L-MBTCP module with Modbus server devices, a command list needs to be created. The commands in the list specify the server device to be addressed, the function to be performed (read or write), the data area in the device to interface with and the registers in the internal database to be associated with the device data.

Each of the 10 Client command lists supports up to 16 commands each. The command list is processed from top (Command #0) to bottom.

Read commands are executed without condition. Write commands can be set to execute only if the data in the write command changes (Conditional Enable). If the register data values in the command have not changed since the command was last issued, the command will not be executed. This feature can be used to optimize network performance.

The MBTCP Modbus Client (and Server) communication drivers support several data read and write commands. When a command is configured, the type of data (bit, 16-bit integer, 32-bit float, etc), and the level of Modbus support in the server equipment will need to be considered. For information on floating-point support, please see the *Floating-Point Support* section on page 120.

Parameter	Value	Description
Enable	Disable, Enable, Conditional Bit/Word Override, Float Override	This field defines whether the command is to be executed and under what conditions. **Disable** (0) = The command is disabled and will not be executed in the normal polling sequence. **Enable** (1) = The command is executed each scan of the command list if the *Poll Interval* (see below) is set to zero. If the Poll *Interval* is set to a nonzero value, the command is executed when the interval timer expires. **Conditional** (2) = For write commands only. The command executes only if the internal data associated with the command changes. **Bit/Word Override** (3) = For read commands only. If a command error occurs, the module will override the associated database area with the *Override Value Upon Error* parameter value. Float Override (4) = For read commands only. If a command error occurs, the module will override the associated database area (2x word count) with the *Override Value Upon Error* parameter value.
Internal Address	0 to 479 (word-level) or 0 to 3839 (bit-level)	Specifies the module's internal database register to be associated with the command. Allowable range is 0 to 9999 for Modbus Function Codes 3, 4, 6, or 16, and 0 to 65535 for Modbus Function Codes 1, 2, 5, or 15. If the command is a read function, the data read from the server device will be *stored* beginning at the module's internal database register value entered in this field. This register value must lie within the Read Data area of the module's memory, defined by the

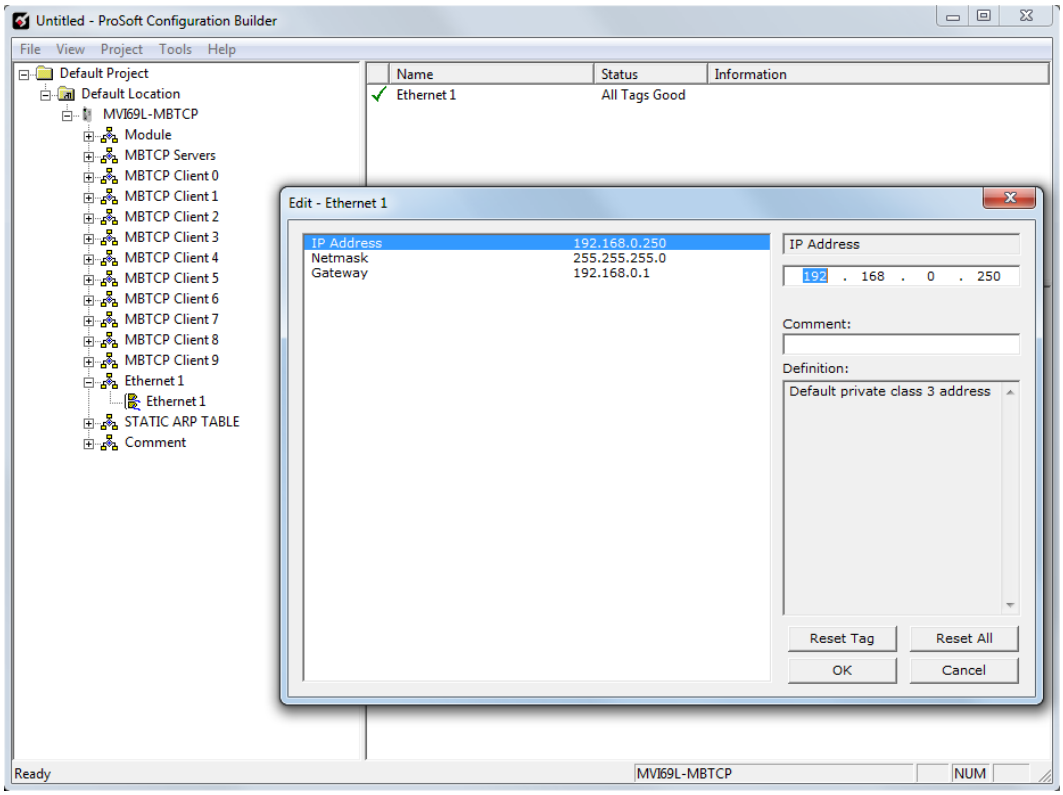
		Read Register Start and *Read Register Count* parameters in the Module section. If the command is a write function, the data to be written to the server device will be *sourced* beginning from the module's internal database register specified. This register value must come from the Write Data area of the module's memory, defined by the *Write Register Start* and *Write Register Count* parameters in the Module section.
Poll Interval	0 to 65535 seconds	Specifies the minimum interval between executions of continuous commands (*Enable* code = 1). Example: If a value of 10 is entered, the command will execute no more frequently than once every 10 seconds. When the command reaches the top of the command queue and 10 seconds has not elapsed, it is skipped until the poll interval has expired.
Register Count	1 to 125 (words) or 1 to 800 (coils)	Specifies the number of registers or digital points to be associated with the command. Modbus Function Codes 5 and 6 ignore this field as they only apply to a single data point. For Modbus Function Codes 1, 2 and 15, this parameter sets the number of single bit digital points (inputs or coils) to be associated with the command. For Modbus Function Codes 3, 4 and 16, this parameter sets the number of 16-bit registers to be associated with the command.
Swap Code	No Change, Word Swap, Word and Byte Swap, Byte Swap	Defines if the data received from the Modbus server is to be ordered differently than received from the server device. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard method of storage of these data types in server devices. This parameter can be set to order the register data received in an order useful by other applications. **No Change** = No change is made in the byte ordering (ABCD = ABCD) **Word Swap** = The words are swapped (ABCD= CDAB) **Word and Byte Swap** = The words are swapped, then the bytes in each word are swapped (ABCD=DCBA) **Byte Swap** = The bytes in each word are swapped (ABCD=BADC) Note: Each pair of characters is a byte. Ex: AB and CD. Two pairs of characters is 16-bit register Ex: ABCD.
Node IP Address	xxx.xxx.xxx.xxx	Specifies the IP address of the target device being addressed by the command.
Service Port	1 to 9999	Use a value of 502 when addressing Modbus TCP/IP servers which are compatible with the Schneider Electric MBAP specifications (this will be most devices). If a server implementation supports another service port, enter the value here. Service Port 2000 is

		common for encapsulated format messages.
Slave Address	0 to 255	Mainly used for Modbus TCP/IP to serial conversion, this specifies the Modbus slave node address on the serial network to be considered. If a Modbus TCP/IP server device does not have or need a slave address, use a value of '1'. If the value is set to zero, the command will be a broadcast message on the network. The Modbus protocol permits broadcast commands for write operations. Do not use this node address for read operations.
Modbus Function	1,2,3,4,5,6,15,16	Specifies the Modbus function to be executed by the command. These function codes are defined in the Modbus protocol. 1 – Read Coil Status (0xxxx) 2 – Read Input Status (1xxxx) 3 – Read Holding Registers (4xxxx) 4 – Read Input Registers (3xxxx) 5 – Force (Write Single) Coil (0xxxx) 6 – Force (Write Single) Holding Register (4xxxx) 15 – Preset (Write) Multiple Coils (0xxxx) 16 – Preset (Write) Multiple Registers (4xxxx)
MB Address in Device	0 to 479	Specifies the register or digital point address offset within the Modbus server device. The MBTCP Client will read or write from/to this address within the server. Refer to the documentation of each Modbus server device for their register and digital point address assignments. Note: The value entered here does not need to include the "Modbus Prefix" addressing scheme. Also, this value is an offset of the zero-based Modbus addressing scheme. Example: Using a Modbus Function Code 3 to read from address 40010 in the server, a value of '9' would be entered in this parameter. The firmware (internally) adds a '40001' offset to the value entered. This is the same for all Modbus addresses (0x, 1x, 3x, 4x).
Override Value Upon Error		This parameter is only applicable for *Enable Codes* 3 (Bit/Word Override) or 4 (Float Override). If an error occurs associated to a read command the module will automatically populate the associated database area with this override value.

3.2.5 Ethernet 1

This section defines the permanent IP address, Subnet Mask, and Gateway of the module.

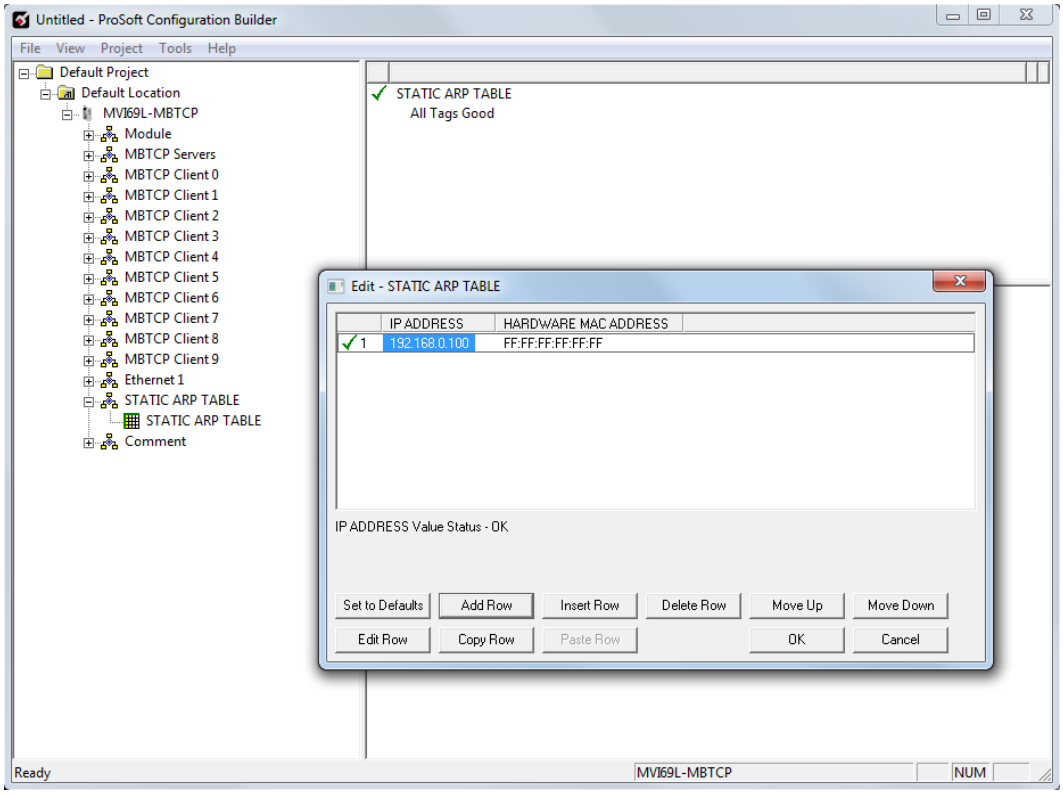
Parameter	Description
IP Address	Unique IP address assigned to the module
Netmask	Subnet mask of module
Gateway	Gateway (if used)



3.2.6 Static ARP Table

This section defines a list of static IP addresses that the module will use when an ARP (Address Resolution Protocol) is required. The module will accept up to 40 static IP/MAC Address data sets.

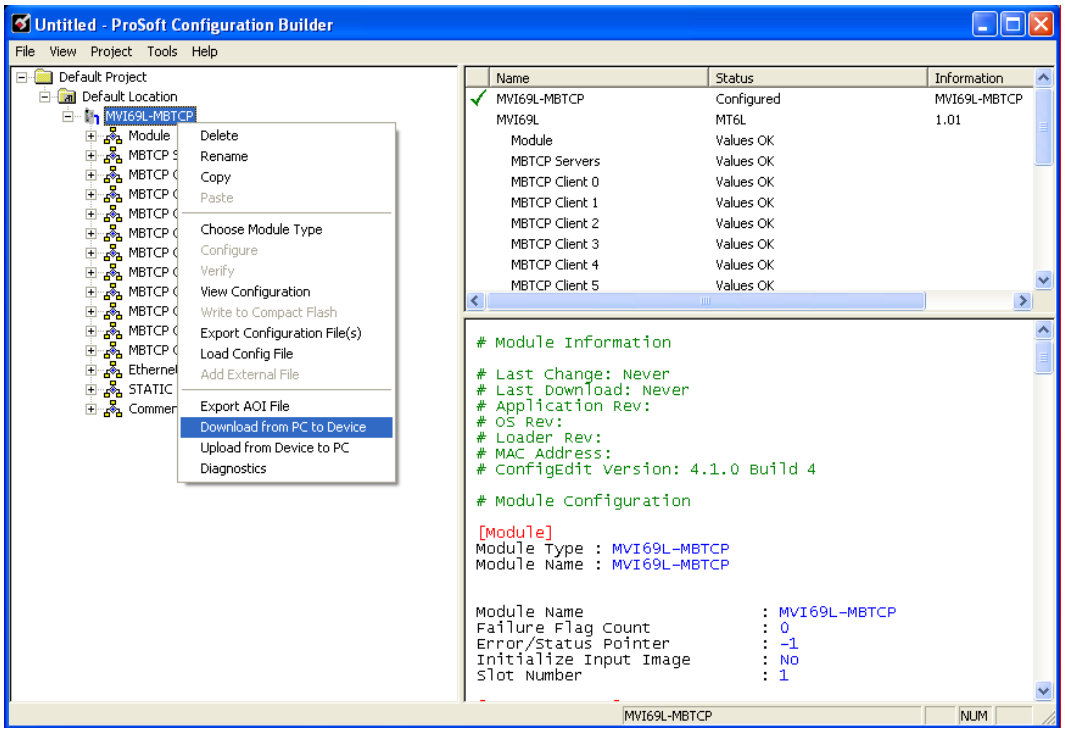
Use the Static ARP table to reduce the amount of network traffic by specifying IP addresses and their associated MAC (hardware) addresses that the MVI69L-MBTCP module will be communicating with regularly.



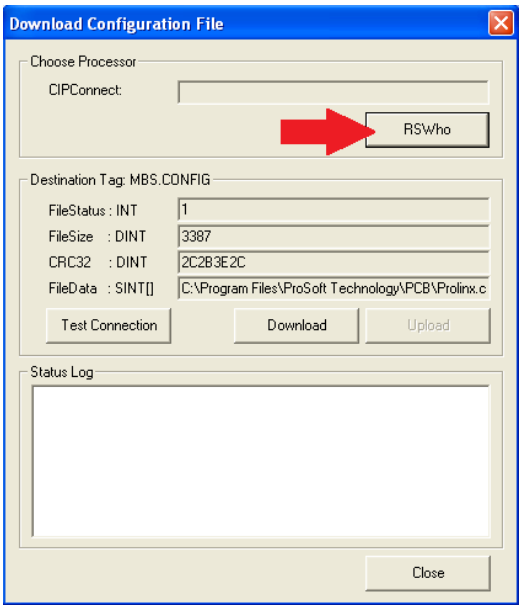
Parameter	Value	Description
IP Address	xxx.xxx.xxx.xxx	This table contains a list of static IP addresses that the module will use when an ARP is required. The module will accept up to 40 static IP/MAC address data sets. **Important:** If the device in the field is changed, this table must be updated to contain the new MAC address for the device and downloaded to the module. If the MAC is not changed, no module communications will be provided.
Hardware MAC Address	FF.FF.FF.FF.FF.FF	This table contains a list of static MAC addresses that the module will use when an ARP is required. The module will accept up to 40 static IP/MAC address data sets. **Important:** If the device in the field is changed, this table must be updated to contain the new MAC address for the device and downloaded to the module. If the MAC is not changed, no communications with the module will occur.

3.3 Downloading the Configuration File to the Processor

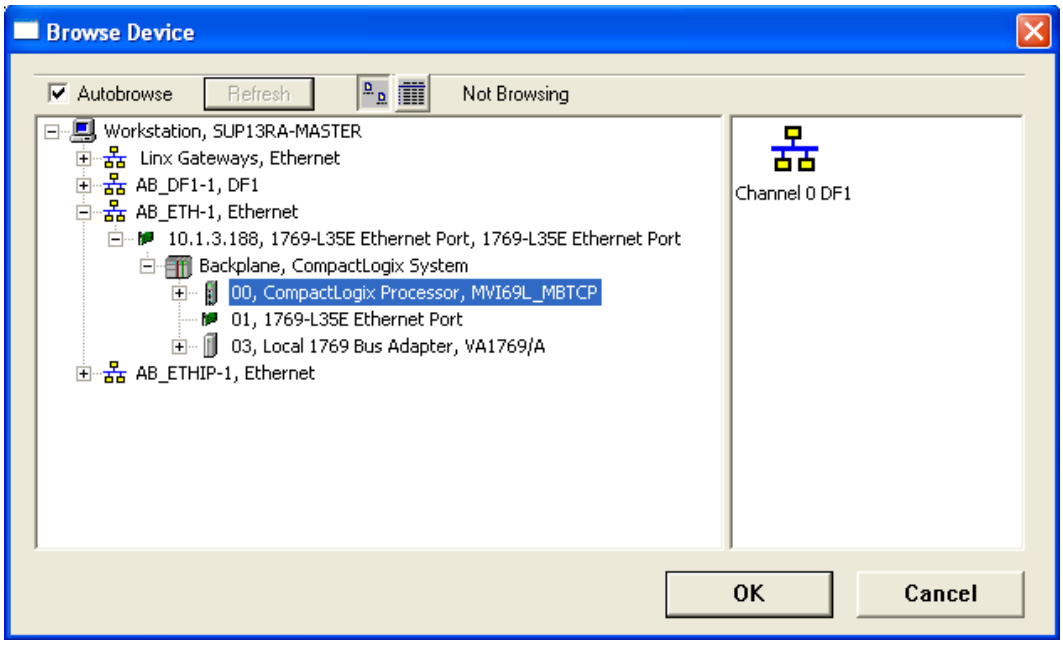
1 In PCB's tree view, right-click the module icon and select **DOWNLOAD FROM PC TO DEVICE** from the shortcut menu.



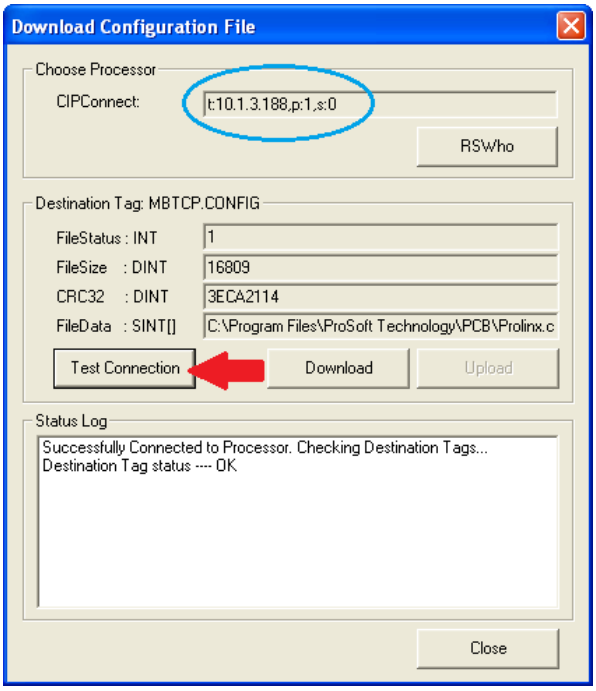
2 In the Download Configuration File window, click the **RSWHO** button.



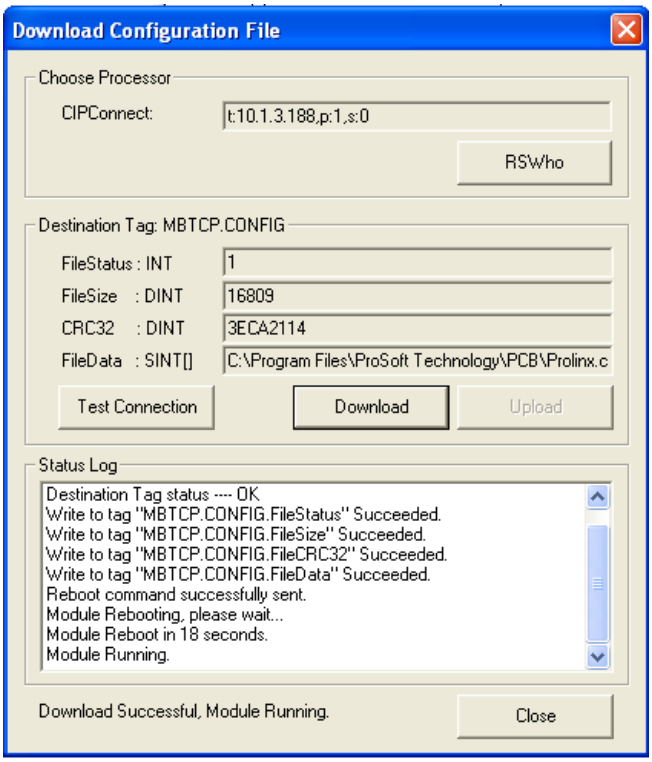
3 Browse and highlight the CompactLogix processor and click **OK**.



4 Notice the CIPConnect path has been updated in the Download Configuration File. Click **TEST CONNECTION** to verify the path is active and can successfully connect to the processor.



5 When ready, click **DOWNLOAD** to download the configuration file to the processor. Following the download process, the module will automatically be rebooted.

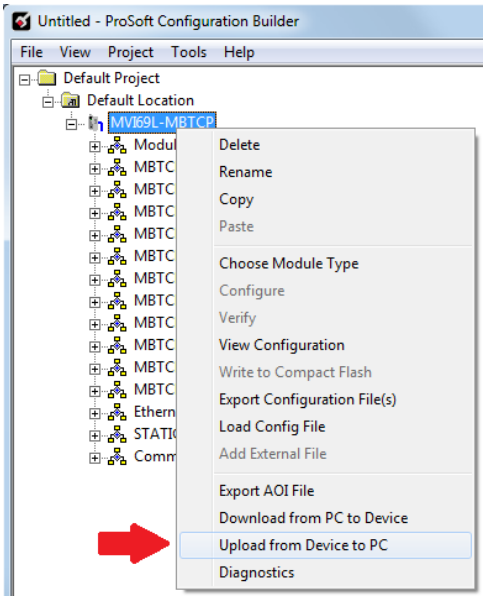


6 Upon reboot, the ladder logic sends the configuration data from the processor to the module.

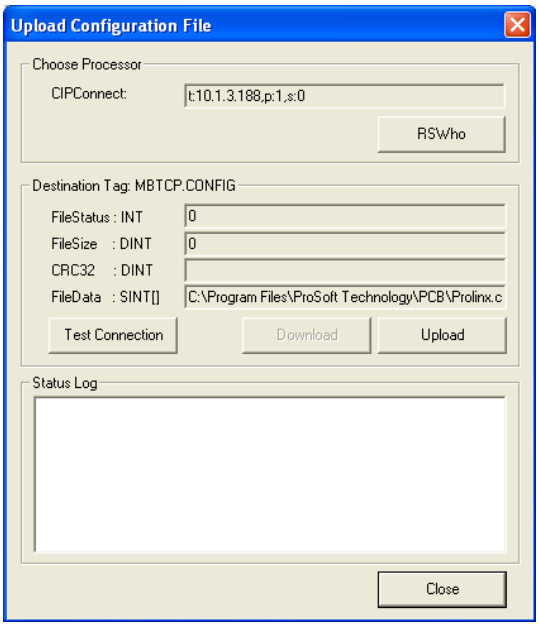
7 When the reboot is complete, the module will start Modbus communications.

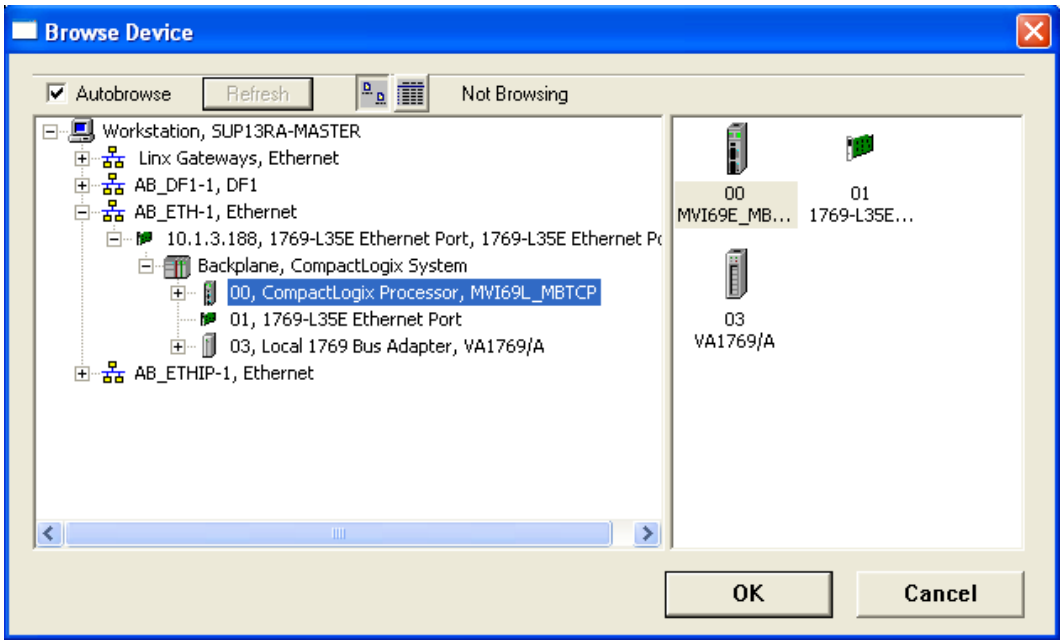
3.4 Uploading the Configuration File from the Processor

1 In PCB's tree view, right-click the module icon and select **UPLOAD FROM DEVICE TO PC** from the shortcut menu.

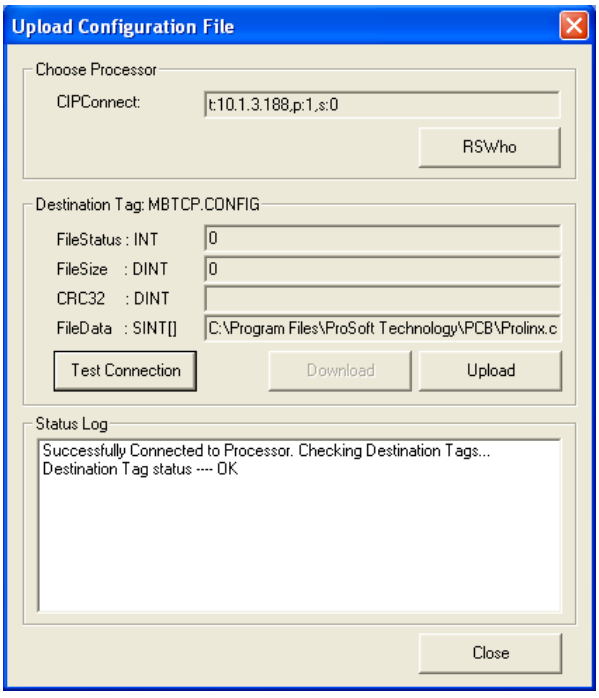


2 In the Upload Configuration File window, the CIPConnect path should already be constructed if you have previously downloaded the configuration file from the same PC. If not, click on the **RSWHO** button, browse to select the CompactLogix Processor, and click **OK**.

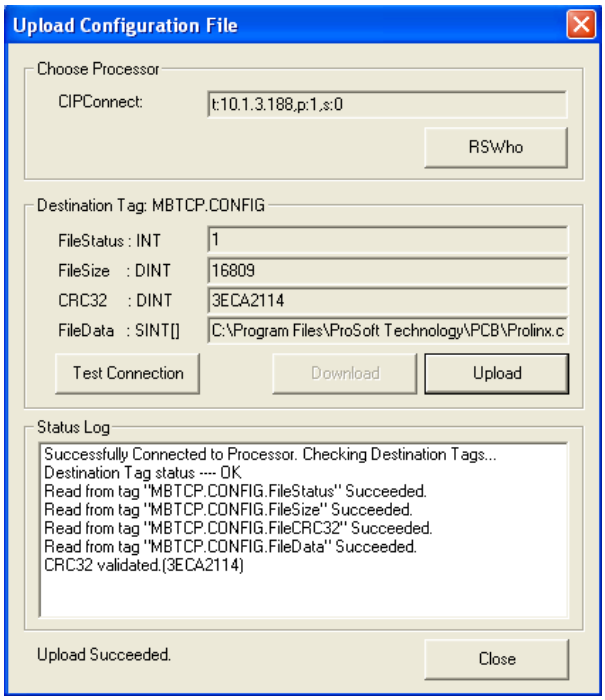




3 Click **TEST CONNECTION** to verify the path is active and can successfully connect to the processor.



4 When ready, click **UPLOAD**. When complete, click **Close.**



5 PCB will now display the uploaded configuration file.

4 Backplane Data Exchange

In This Chapter

- Backplane Data Transfer 68
- Normal Data Transfer 69
- Data Flow Between the Module and Processor 71

Ladder logic is required for the MVI69L-MBTCP module to communicate with the CompactLogix processor across the backplane. The ladder logic handles the module data transfer, configuration data transfer, special block handling, and status data receipt.

For most applications, the sample Add-On Instruction (which includes the ladder logic) will work without modification.

The following topics describe several concepts that are important for understanding the operation of the MVI69L-MBTCP module.

1. On power up the module begins the following logical functions:
   - Initialize hardware components
   - Initialize CompactLogix backplane driver
   - Test and clear all RAM

2. Read configuration from the CompactLogix processor via ladder logic

3. Allocate and initialize Module Register space

4. Enable Modbus TCP/IP Ethernet port

5. After the module has received the Module Configuration, the module will begin communicating with other devices on the Modbus network, depending on the configuration

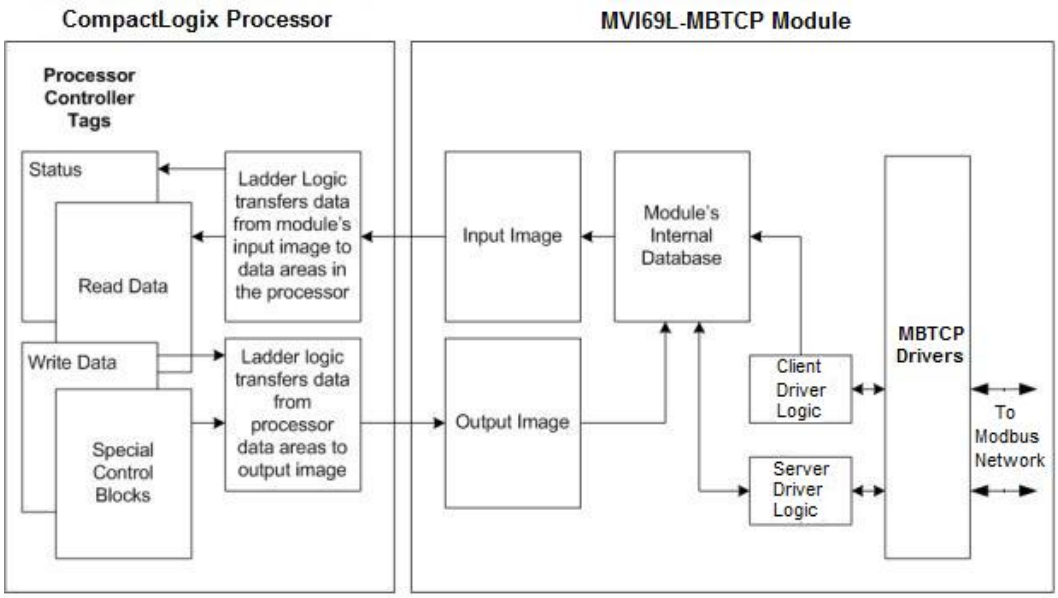
4.1 Backplane Data Transfer

The MVI69L-MBTCP module communicates directly over the CompactLogix backplane. Data is paged between the module and the CompactLogix processor across the backplane using the module's input and output images. The update frequency of the images is determined by the scheduled scan rate defined by the user for the module and the communication load on the module. Typical updates are in the range of 1 to 10 milliseconds per block of information.

This bi-directional transference of data is accomplished by the module filling in data in the module's input image to send to the processor. Data in the input image is placed in the Controller Tags in the processor by the ladder logic. The input image for the module is 242 words. This data area permits fast throughput of data between the module and the processor.

The processor inserts data to the module's output image to transfer to the module. The module's program extracts the data and places it in the module's internal database. The output image for the module is 241.

The following illustration shows the data transfer method used to move data between the CompactLogix processor, the MVI69L-MBTCP module and the Modbus Network.



All data transferred between the module and the processor over the backplane is through the input and output images. Ladder logic is needed in the CompactLogix processor to interface the input and output image data with data defined in the Controller Tags. All data used by the module is stored in its internal database. This database is defined as virtual MBTCP data tables with addresses from 0 to 239 each.

4.2 Normal Data Transfer

Normal data transfer includes the paging of the user data found in the module's internal database and the status data. These data are transferred through read (input image) and write (output image) blocks. The following topics describe the structure and function of each block.

4.2.1 Write Block: Request from the Processor to the Module

These blocks of data transfer information from the processor to the module. The structure of the output image used to transfer this data is shown below:

Offset	Description	Length (words)
0	Write Block ID	1
1 to 240	Write Data	240

The Write Block ID is an index value used to determine the location in the module's database where the data will be placed.

4.2.2 Read Block: Response from the Module to the Processor

These blocks of data transfer information from the module to the processor. The structure of the input image used to transfer this data is shown below:

Offset	Description	Length (words)
0	Read Block ID	1
1	Write Block ID	1
2 to 241	Read Data	240

4.2.3 Read and Write Block Transfer Sequences

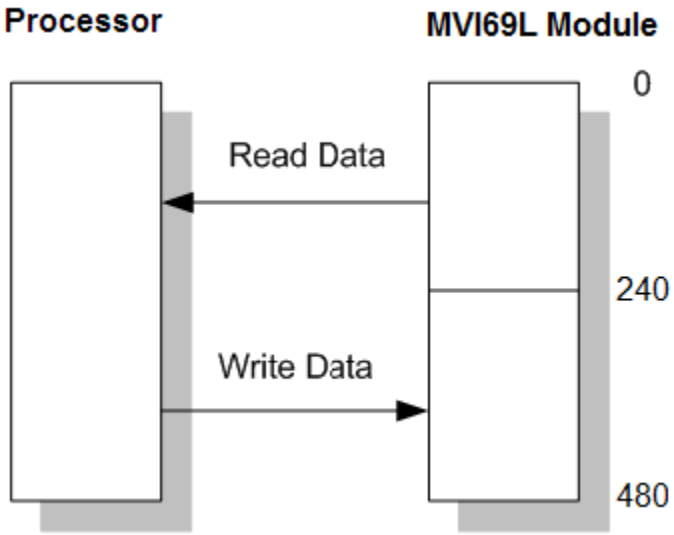
There are 240 words of data transferred per block along the backplane between the module and the processor.

The Write Block ID associated with the block requests data from the processor. Under normal program operation, the module sequentially sends read blocks and requests write blocks. The application uses one read and one write block, the sequence is as follows:

R1W1→ R1W1→ R1W1→ R1W1→…

This sequence continues until interrupted by other write block numbers sent by the controller or by a command request from a node on the Modbus network or operator control through the module's Ethernet port.

The backplane communication is configured as follows:



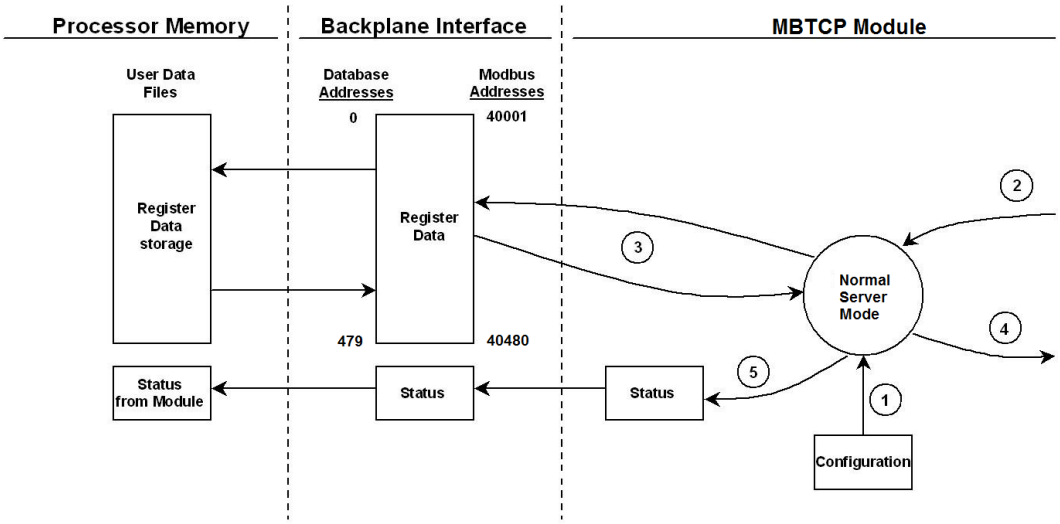
Database address 0 to 239 is continuously transferred from the module to the processor. Database address 240 to 479 is continuously transferred from the processor to the module.

4.3 Data Flow Between the Module and Processor

The following topics describe the flow of data between the two pieces of hardware (CompactLogix processor and MVI69L-MBTCP module) and other nodes on the Modbus network. The module can act as a Modbus TCP/IP Client (master), Server (slave), or both simultaneously.

4.3.1 Server Driver Overview

The Server driver allows the MVI69L-MBTCP module to respond to read and write commands issued by a Client on the Modbus network. The following diagram shows the data flow for normal server mode.

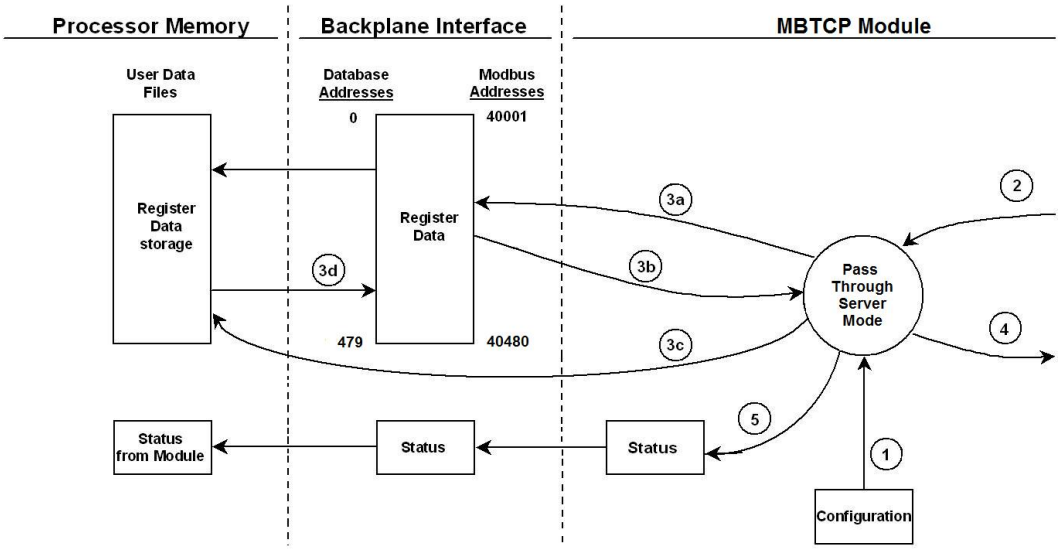


Step	Description
1	Any time the module restarts (boots or reboots), the Server port driver receives configuration information from the MBTCP controller tags. This information configures the ethernet port and defines Server driver characteristics. The configuration information may also contain instructions to offset data stored in the database to addresses different from addresses requested in the received messages.
2	A Modbus Client device, such as a Modicon PLC or an HMI application, issues a read or write command to the module's IP address. The Server driver qualifies the message before accepting it into the module. Rejected commands will cause an Exception Response.
3	After the module accepts the command, the data is immediately transferred to or from the module's internal database. On a read command, the data is read from of the database and a response message is built. On a write command, the data is written directly into the database and a response message is built.
4	After Steps 2 and 3 have been completed, either a normal response message or an Exception Response message is sent to the Client.
5	Counters are available in the Status Block to permit the ladder logic program to determine the level of activity of the Server driver.

In Server Pass-Through mode, write commands from the Client are handled differently than they are in Normal mode. In Pass-Through mode, all write requests are passed directly to the processor and data is not written directly into the module's database.

This mode is especially useful when both a Modbus Client and the module's processor logic need to be able to read and write values to the same internal database addresses.

The following diagram shows the data flow for a server port with pass-through enabled:



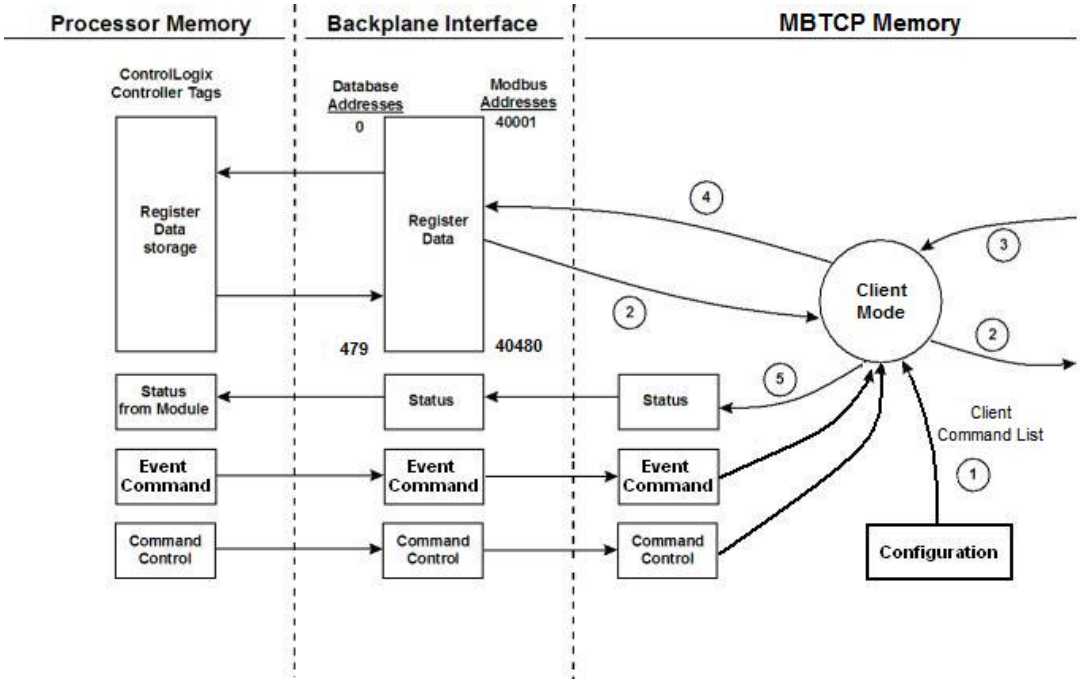
Step	Description
1	Same as normal mode.
2	Same as normal mode.
3	a. In Pass-Through mode, if the Server Driver receives a read request, it looks for the data in module's internal database, just as it would in Normal mode. b. The data needed to respond to the read command is retrieved directly from the internal database and returned to the Server Driver so it can build a response message. c. In Pass-Through mode, if the Server Driver receives a write request, it does not send the data directly to the module's internal database. It puts the data to be written into a special Input Image with a special Block ID code to identify it as a Pass-Through Write Block and substitutes this special block in place of the next regular Read Data Block. The special block is processed by the ladder logic and the data to be written is placed into the *WriteData* controller tag array at an address that corresponds to the Modbus Address received in the write command. d. During normal backplane communications, the data from the *WriteData* array, including the data updated by the Pass-Through Write Block, is sent to the module's internal database. This gives the ladder logic the opportunity to also change the values stored in these addresses, if need be, before they are written to the database. Note: The *ReadData* array is not used in Pass-Through mode.
4	Same as normal mode.
5	Same as normal mode.

4.3.2 Client Driver Overview

In Client mode, the MVI69L-MBTCP module issues read or write commands to server devices on the Modbus network. These commands are user-configured in ProSoft Configuration Builder Client Command List. This list is transferred to the module when the module receives its configuration from the processor.

The commands can also be issued directly from the CompactLogix processor (Special Command Blocks).

Command status is returned to the processor for each individual command in the command list. The command status list is user-defined in module memory. Below describes the flow of command data into and out of the module.



Step	Description
1	Upon module boot-up, the Client Driver obtains configuration data from the MBTCP controller tags. The configuration data obtained includes Ethernet configuration and the Client Command List. Special Commands can be issued directly from the CompactLogix processor using Event Commands and Command Control. These command values are used by the Client Driver to determine the types and order of commands to send to servers on the network.
2	After configuration, the Client Driver begins transmitting read and/or write commands to server nodes on the network. If the Client Driver is writing data to a server, the data for the write command is obtained from the module's internal database.
3	Once the specified server has successfully processed the command, it will return a response message to the Client driver for processing.
4	Data received from a server in response to a read command is stored in the module's internal database.
5	Status is returned to the processor for each command in the Client Command List.

Important: Take care when constructing each command in the list to ensure predictable operation of the module. If two commands write to the same internal database address of the module, the results will be invalid. All commands containing invalid data are ignored by the module.

Client Command List

Up to 10 Modbus TCP/IP Client connections can be defined in the MVI69L-MBTCP. Each Client connection can contain up to 16 commands each.

A valid command includes the following items:

- Command enable mode: (0) disabled, (1) continuous or (2) conditional for write commands only
- Source or destination database address: The module's database address where data will be written or read.
- Count: The number of words or bits to be transferred – up to 125 words for Function Codes 3, 4, or 16, and up to 2000 bits for Function Codes 1, 2, or 15.

Note: 125 words is the maximum count allowed by the Modbus protocol. Some field devices may support less than the full 125 words. Check with the device manufacturer for the maximum count supported by the particular server.

- Server IP Address
- Modbus Service Port of the server
- Modbus Function Code: This is the type of command that will be issued.
- Source or destination address in the server device

Command Error Codes

As the list is read in from the processor and as the commands are processed, an error value is maintained in the module for each command. The definition for these command error codes is listed on page 103. The command error codes can be viewed in the Diagnostics window of PCB (Page 99). They can also be transferred from the module's database to the processor.

To transfer the Command Error List to the processor, set the *Command Error Offset* parameter in the port configuration to a module database address that is in the module's Read Data area.

Note: The Command Error List must be placed in the Read Data area of the database (Registers 0 to 239), so it can be transferred to the processor in the input image.

5 Using Controller Tags

In This Chapter

- Controller Tags 76
- User-Defined Data Types (UDTs) 78
- Controller Tag Overview 80

Ladder logic is required for managing communication between the MVI69L-MBTCP module and the CompactLogix processor. The ladder logic handles tasks such as:

- Module backplane data transfer
- Special block handling
- Status data receipt

Additionally, a power-up handler may be needed to initialize the module's database and may clear some processor fault conditions.

The sample Import Rung with Add-On Instruction is extensively commented to provide information on the purpose and function of each user-defined data type and controller tag. For most applications, the Import Rung with Add-On Instruction will work without modification.

5.1 Controller Tags

Data related to the MVI69L-MBTCP is stored in the ladder logic in variables called controller tags. Individual controller tags can be grouped into collections of controller tags called controller tag structures. A controller tag structure can contain any combination of:

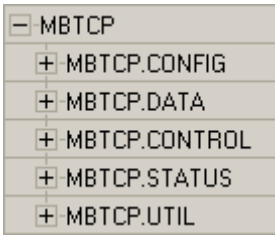
- Individual controller tags
- Controller tag arrays
- Lower-level controller tag structures

The controller tags for the module are pre-programmed into the Add-On Instruction Import Rung ladder logic. You can find them in the *Controller Tags* subfolder, located in the *Controller* folder in the *Controller Organizer* pane of the main RSLogix 5000 window.

This controller tag structure is arranged as a tree structure. Individual controller tags are found at the lowest level of the tree structure. Each individual controller tag is defined to hold data of a specific type, such as integer or floating-point data. Controller tag structures are declared with user-defined data types, which are collections of data types.

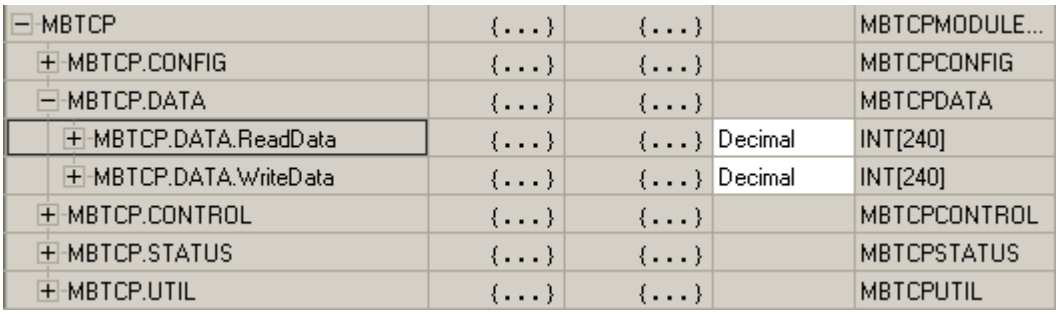
5.1.1 MVI69L-MBTCP Controller Tags

The main controller tag structure, *MBTCP*, is broken down into five lower-level controller tag structures.



The five lower-level controller tag structures contain other controller tags and controller tag structures. Click the **[+]** sign next to any controller tag structure to expand it and view the next level in the structure.

For example, if you expand the *MBTCP.DATA* controller tag structure, you will see that it contains two controller tag arrays, *MBTCP.DATA.ReadData* and *MBTCP.DATA.WriteData*, which are 240-element integer arrays.


MBTCP {...} {...} MBTCPMODULE...
MBTCP.CONFIG {...} {...} MBTCPCONFIG
MBTCP.DATA {...} {...} MBTCPDATA
MBTCP.DATA.ReadData {...} {...} Decimal INT[240]
MBTCP.DATA.WriteData {...} {...} Decimal INT[240]
MBTCP.CONTROL {...} {...} MBTCPCONTROL
MBTCP.STATUS {...} {...} MBTCPSTATUS
MBTCP.UTIL {...} {...} MBTCPUTIL

The controller tags in the Add-On Instruction are commented in the *Description* column.

Notice that the *Data Type* column displays the data types used to declare each controller tag, controller tag array or controller tag structure. Individual controller tags are declared with basic data types, such as INT and BOOL. Controller tag arrays are declared with arrays of basic data types. Controller tag structures are declared with user-defined data types (UDTs).

5.2 User-Defined Data Types (UDTs)

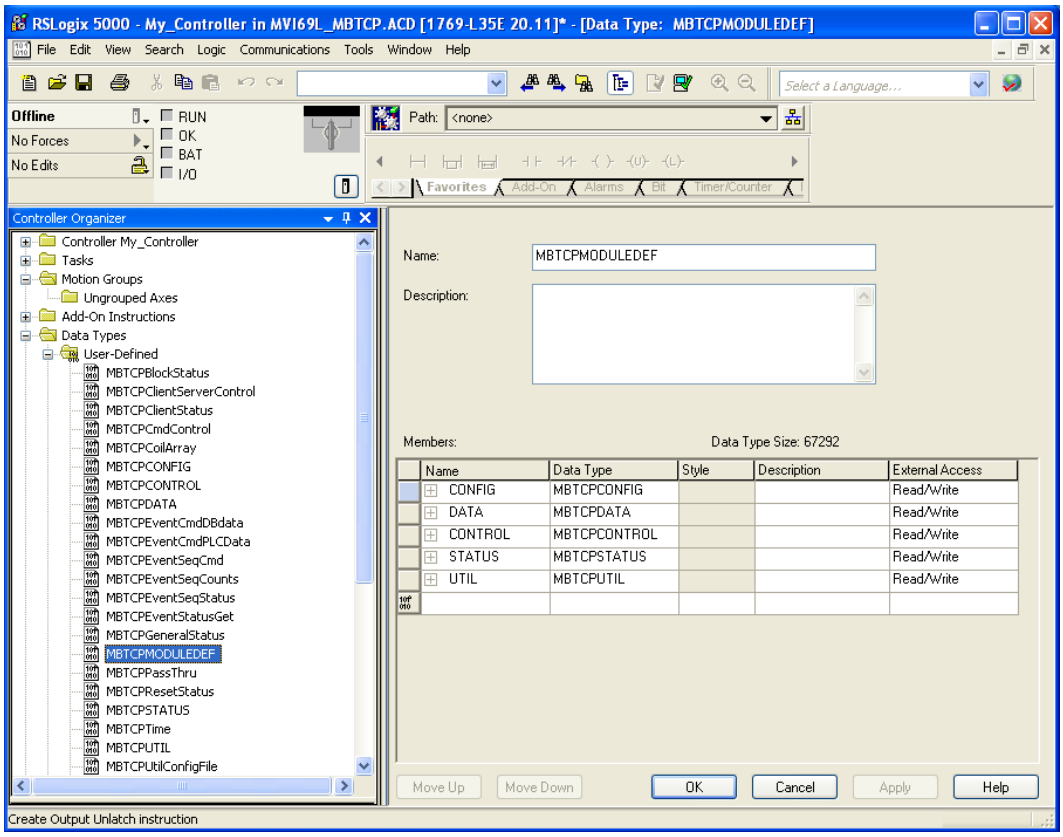
User-defined data types (UDTs) allow users to organize collections of data types into groupings. These groupings, or data type structures, can then be used to declare the data types for controller tag structures. Another advantage of defining a UDT is that it may be re-used in other controller tag structures that use the same data types.

The Add-On Instruction Import Rung ladder logic for the module has pre-defined UDTs. You can find them in the *User-Defined* subfolder, located in the *Data Types* folder in the *Controller Organizer* pane of the main RSLogix window. Like the controller tags, the UDTs are organized in a multiple-level tree structure.

5.2.1 MVI69L-MBTCP User-Defined Data Types

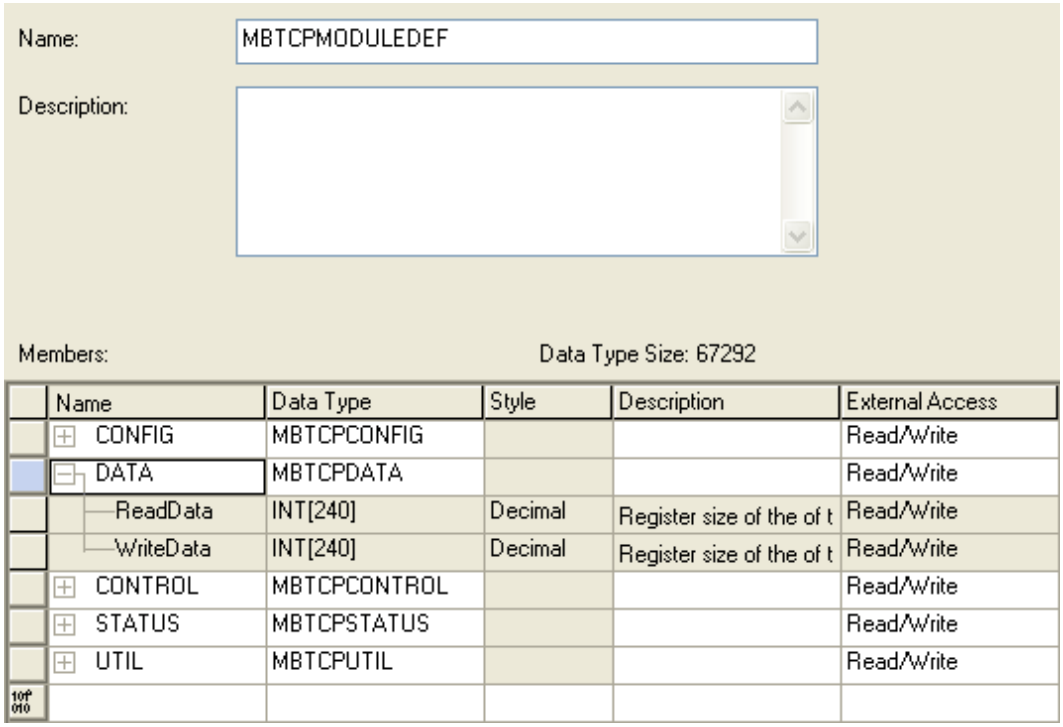
Twenty-two different UDTs are defined for the MVI69L-MBTCP Add-On Instruction.

The main UDT, *MBTCPMODULEDEF*, contains all the data types for the module and was used to create the main controller tag structure, *MBTCP*. There are five UDTs one level below *MBTCPMODULEDEF*. These lower-level UDTs were used to create the *MBTCP.CONFIG*, *MBTCP.DATA*, *MBTCP.CONTROL*, *MBTCP.STATUS*, and *MBTCP.UTIL* controller tag structures.



Click the **[+]** signs to expand the UDT structures and view lower-level UDTs.

For example, if you expand *MBTCP.DATA*, you will see that it contains two UDTs, *ReadData* and *WriteData*. Both of these are 240-element integer arrays.



Name	Data Type	Style	Description	External Access
CONFIG	MBTCPCONFIG			Read/Write
DATA	MBTCPDATA			Read/Write
ReadData	INT[240]	Decimal	Register size of the of t	Read/Write
WriteData	INT[240]	Decimal	Register size of the of t	Read/Write
CONTROL	MBTCPCONTROL			Read/Write
STATUS	MBTCPSTATUS			Read/Write
UTIL	MBTCPUTIL			Read/Write

Notice that these UDTs are the data types used to declare the *MBTCP.DATA.ReadData* and *MBTCP.DATA.WriteData* controller tag arrays. The UDTs are commented in the *Description* column.

5.3 Controller Tag Overview

Tag Name	Description
MBTCP.CONFIG	Configuration information
MBTCP.DATA	MBTCP input and output data transferred between the processor and the module
MBTCP.CONTROL	Governs the data movement between the PLC rack and the module
MBTCP.STATUS	Status information
MBTCP.UTIL	Generic tags used for internal ladder processing (DO NOT MODIFY)

The following sections describe each of these controller tag structures in more detail.

5.3.1 MBTCP.CONFIG

When PCB downloads the configuration file from the PC to the processor, the configuration file data and its CRC are stored in this array.

Edits cannot be done directly in this array. All configuration edits must be done in PCB since a unique CRC is calculated for data integrity. Any change to the configuration parameters directly in this array will not match the calculated CRC.

Tag Name	Description
MBTCP.CONFIG.FileData	This parameter contains the MBTCP configuration data after it has been downloaded from PCB. It is displayed in ASCII format. **Note**: MBTCP configuration changes cannot be made directly in this array; the configuration must be downloaded via PCB.
MBTCP.CONFIG.FileSize	Configuration file size (MBTCP.CONFIG.FileData array) in bytes.
MBTCP.CONFIG.FileCRC32	CRC checksum of the configuration file stored in the array.
MBTCP.CONFIG.FileStatus	Configuration file status. 0 = No file present, 1 = File present

5.3.2 MBTCP.DATA

This array contains the Read Data and Write Data arrays for processor-to-module communication.

Tag Name	Description
MBTCP.DATA.ReadData	Data area copied from the module to the processor. This 240-element array stores the Modbus data coming into the module from the Modbus network.
MBTCP.DATA.WriteData	Data area copied from the processor to the module. This 240-element array stores the outgoing data sent from the module to the Modbus network.

5.3.3 MBTCP.CONTROL

This array handles special tasks requested by the processor.

5.3.3.1 MBTCP.CONTROL.CommandControl

This array allows the processor to dynamically enable configured commands for execution.

Tag Name	Range	Description
MBTCP.CONTROL.CommandControl.Trigger	0 or 1	Command Control: Disable = 0, Enable = 1
MBTCP.CONTROL.CommandControl.CommandID	1 to 16	This value represents the number of commands to be requested in the Command Control block (1 to 16).
MBTCP.CONTROL.CommandControl.ClientID	0 to 9	Client ID associated with the command to be executed.
MBTCP.CONTROL.CommandControl.CommandIndex	0 to 15	This array stores the Client x command indexes to be executed. Up to 16 command indexes can be stored here.
MBTCP.CONTROL.CommandControl.CmdsAddedToQue	-1 or -2	This value is returned from the module. This number of commands added to the queue. -1 = Client not enabled and active -2 = Client index not valid
MBTCP.CONTROL.CommandControl.CmdInQue		Number of Commands in Queue waiting to be executed

5.3.3.2 MBTCP.CONTROL. EventCommand_DBData

This array allows the processor to dynamically build Modbus commands with data associated to the module's database. This feature is meant for periodic execution such as: Resetting clock, zeroing-out counters, etc.

Tag Name	Range	Description
MBTCP.CONTROL.EventCommand_DBData.Trigger	0 or 1	Toggle to send Event Command. 0 = Disable, 1 = Enable
MBTCP.CONTROL.EventCommand_DBData.ClientID	0 to 9	Client ID associated with the command to be executed
MBTCP.CONTROL.EventCommand_DBData.ServerIPaddress	xxx.xxx.xxx.xxx	IP address of target Modbus server
MBTCP.CONTROL.EventCommand_DBData.ServicePort	502 or 2000	Service port of target Modbus server
MBTCP.CONTROL.EventCommand_DBData.SlaveAddress	1 to 255	Slave address of target Modbus TCP/IP to serial device, if applicable
MBTCP.CONTROL.EventCommand_DBData.InternalDBaddress	0 to 479 (word-level) or 0 to 3839 (bit-level)	Specifies the module's internal database register to be associated with the command. Allowable range is 0 to 479 for Modbus Function Codes 3, 4, 6, or 16, and 0 to 3839 for Modbus Function Codes 1, 2, 5, or 15.
MBTCP.CONTROL.EventCommand_DBData.RegisterCount	1 to 125 (words) or 1 to 800 (coils)	Specifies the number of registers or digital points to be associated with the command. Modbus Function Codes 5 and 6 ignore this field as they only apply to a single data point.

MBTCP.CONTROL.EventCommand_DBData.SwapCode	0,1,2,3	Defines if the data received from the Modbus server is to be ordered differently than received from the server device. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard method of storage of these data types in server devices.
MBTCP.CONTROL.EventCommand_DBData.ModbusFC	1,2,3,4,5,6,15,16	Specifies the Modbus function to be executed by the command.
MBTCP.CONTROL.EventCommand_DBData.DeviceModbusAddress	0 to 9999	Specifies the register or digital point address offset within the Modbus server device. The MBTCP Client will read or write from/to this address within the server.
MBTCP.CONTROL.EventCommand_DBData.StatusReturned	0, 1, or -1	0 = Fail 1 = Success -1 = Client is not Enabled and Active
MBTCP.CONTROL.EventCommand_DBData.CmdInQue		Number of Commands in Queue waiting to be executed

5.3.3.3 MBTCP.CONTROL.EventCommand_PLCData

This array allows the processor to dynamically build Modbus commands with PLC processor data. This feature is meant for periodic execution such as a clock reset, zeroing-out counters, etc.

Tag Name	Range	Description
MBTCP.CONTROL.EventCommand_PLCData.Trigger	0 or 1	Toggle to send Event Command. 0 = Disable, 1 = Enable
MBTCP.CONTROL.EventCommand_PLCData.ClientID	0 to 9	Client ID associated with the command to be executed
MBTCP.CONTROL.EventCommand_PLCData.ServerIPaddress	xxx.xxx.xxx.xxx	IP address of target Modbus server
MBTCP.CONTROL.EventCommand_PLCData.ServicePort	502 or 2000	Service port of target Modbus server
MBTCP.CONTROL.EventCommand_PLCData.SlaveAddress	1 to 255	Slave address of target Modbus TCP/IP to serial device, for backwards compatibility
MBTCP.CONTROL.EventCommand_PLCData.ModbusFunctionCode	1,2,3,4,5,6,15,16	Specifies the Modbus function to be executed by the command.
MBTCP.CONTROL.EventCommand_PLCData.DeviceDBAddress	0 to 9999	Specifies the register or digital point address offset within the Modbus server. The MBTCP Client will read or write from/to this address within the server.
MBTCP.CONTROL.EventCommand_PLCData.PointCount	1 to 125 (words) or 1 to 800 (coils)	Specifies the number of registers or digital points to be associated with the command. Modbus Function Codes 5 and 6 ignore this field as they only apply to a single data point.
MBTCP.CONTROL.EventCommand_PLCData.Data		Data values associated with the command
MBTCP.CONTROL.EventCommand_PLCData.ErrorStatus		Command status after execution

5.3.3.4 MBTCP.CONTROL.EventSequenceCommand

This tag array contains the values needed to build one Modbus TCP/IP command, have it sent to a specific Client on the module, and control the processing of the returned response block.

Tag Name	Range	Description
MBTCP.CONTROL.EventSequence Command.Trigger	0 or 1	Toggle to send Event Sequence Command. 0 = Disable, 1 = Enable
MBTCP.CONTROL.EventSequence Command.ClientID	0 to 19	Client ID associated with the command to be executed
MBTCP.CONTROL.EventSequence Command.ServerIPaddress	xxx.xxx.xxx. xxx	IP address of target Modbus server
MBTCP.CONTROL.EventSequence Command.ServicePort	502 or 2000	Service port of target Modbus server
MBTCP.CONTROL.EventSequence Command.SlaveAddress	1 to 255	Slave address of target Modbus TCP/IP to serial device, if applicable
MBTCP.CONTROL.EventSequence Command.InternalDBaddress	0 to 479 (word-level) or 0 to 3839 (bit-level)	Specifies the module's internal database register to be associated with the command. Allowable range is 0 to 479 for Modbus Function Codes 3, 4, 6, or 16, and 0 to 3839 for Modbus Function Codes 1, 2, 5, or 15.
MBTCP.CONTROL.EventSequence Command.RegisterCount	1 to 125 (words) or 1 to 800 (coils)	Specifies the number of registers or digital points to be associated with the command. Modbus Function Codes 5 and 6 ignore this field as they only apply to a single data point.
MBTCP.CONTROL.EventSequence Command.SwapCode	0,1,2,3	Defines if the data received from the Modbus server is to be ordered differently than received from the server device. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard method of storage of these data types in server devices.
MBTCP.CONTROL.EventSequence Command.ModbusFC	1,2,3,4,5,6,1 5,16	Specifies the Modbus function to be executed by the command.
MBTCP.CONTROL.EventSequence Command.DeviceModbusAddress	0 to 9999	Specifies the register or digital point address offset within the Modbus server device. The MBTCP Client will read or write from/to this address within the server.
MBTCP.CONTROL.EventSequence Command.SequenceNumber		Event Sequence Command Number
MBTCP.CONTROL.EventSequence Command.StatusReturned	0, 1, or -1	Event Sequence Command Returned 0 = Fail 1 = Success -1 = Client disabled /inactive
MBTCP.CONTROL.EventSequence Command.CmdInQue		Number of Event Sequence commands in queue

5.3.3.5 MBTCP.CONTROL.Time

This array allows the processor to get or set module time.

Tag Name	Range	Description
MBTCP.CONTROL.Time.SetTime	0 or 1	Sends the PLC time to the module 0 = Disable, 1 = Enable
MBTCP.CONTROL.Time.GetTime	0 or 1	Retrieves the time from the module to PLC 0 = Disable, 1 = Enable
MBTCP.CONTROL.Time.Year	0 to 9999	Four digit year value. Example: 2014
MBTCP.CONTROL.Time.Month	1 to 12	Month
MBTCP.CONTROL.Time.Day	1 to 31	Day
MBTCP.CONTROL.Time.Hour	0 to 23	Hour
MBTCP.CONTROL.Time.Minute	0 to 59	Minute
MBTCP.CONTROL.Time.Second	0 to 59	Second
MBTCP.CONTROL.Time.Milliseconds	0 to 999	Millisecond
MBTCP.CONTROL.Time.Error	0 or -1	0 = OK, -1 = Error present

5.3.3.6 MBTCP.CONTROL.ClientServerControl

This array allows the control and retrieval of driver command active bits.

Tag Name	Range	Description
MBTCP.CONTROL.ClientServer Control.Trigger	0 or 1	Toggle Client/Server Control 0 = Disable, 1 = Enable
MBTCP.CONTROL.ClientServer Control.ActiveServer	0 or 1	Server active state: 0 = Disable, 1 = Enable
MBTCP.CONTROL.ClientServer Control.ActiveClient_0to9		Client 0 - 9 bit map for active status of clients
MBTCP.CONTROL.ClientServer Control.ActiveClientCmd[x]	0 or 1	Client 0 to 9 command active bits. One word for each Client. Each bit is a command. 0=Disable, 1=Enable
MBTCP.CONTROL.ClientServer Control.GetStatus	0 or 1	Toggle request for status 0 = Disable, 1 = Enable
MBTCP.CONTROL.ClientServer Control.ServerStatus	0 or 1	Server active state 0=Disabled, 1= Enabled
MBTCP.CONTROL.ClientServer Control.Client_0to9Status		Client 0 - 9 bit map for active status of clients
MBTCP.CONTROL.ClientServer Control.ClientCmdStatus[x]	0 or 1	Clients 0 to 9 command active bits. One word for each Client. Each bit is a command. 0=Disabled, 1=Enabled

5.3.3.7 MBTCP.CONTROL.ResetStatus

This array resets the module along with client and server status tags.

Tag Name	Range	Description
MBTCP.CONTROL.ResetStatus. Trigger	0 or 1	Toggle reset control 0 = Disable, 1 = Enable
MBTCP.CONTROL.ResetStatus. Module	0 or x	Reset Module status (0=no, else yes with any none-zero value)
MBTCP.CONTROL.ResetStatus. Server	0 or x	Reset Server status (0=no, else yes with any none-zero value)
MBTCP.CONTROL.ResetStatus. Client	0 or x	Reset Client status (0=no, else yes with any none-zero value)

5.3.3.8 MBTCP.CONTROL.EventSequenceCounts

This tag triggers the counting of the event sequence operation.

Tag Name	Range	Description
MBTCP.CONTROL.EventSequence Counts	0 or 1	Triggers the counting of Event Sequence 0 = Disable, 1 = Enable

5.3.3.9 MBTCP.CONTROL.EventSequenceStatus

This tag triggers the request for the event sequence status.

Tag Name	Range	Description
MBTCP.CONTROL.EventSequence Status	0 or 1	Triggers Event Sequence Status read 0 = Disable, 1 = Enable

5.3.3.10 MBTCP.CONTROL.GetGeneralStatus

This tag triggers the request for the general status of the module.

Tag Name	Range	Description
MBTCP.CONTROL.GetGeneral Status	0 or 1	Triggers general status read 0 = Disable, 1 = Enable

5.3.3.11 MBTCP.CONTROL.GetEventDataStatus

This tag triggers the request of the event status.

Tag Name	Range	Description
MBTCP.CONTROL.GetEventData Status	0 or 1	Triggers Event Status read 0 = Disable, 1 = Enable

5.3.3.12 MBTCP.CONTROL. ColdBoot

This tag triggers the processor to Coldboot the module (full reboot).

Tag Name	Range	Description
MBTCP.CONTROL.ColdBoot	0 or 1	Triggers a cold boot of the module 0 = Disable, 1 = Enable

5.3.3.13 MBTCP.CONTROL.WarmBoot

This tag triggers the processor to Warmboot the module (driver reboot).

Tag Name	Range	Description
MBTCP.CONTROL.WarmBoot	0 or 1	Triggers a warm boot the module 0 = Disable, 1 = Enable

5.3.4 MBTCP.STATUS

This array contains the status information of the module.

5.3.4.1 MBTCP.STATUS.Block

This array contains block status.

Tag Name	Description
MBTCP.STATUS.Block.Read	Total number of read blocks transferred from the module to the processor
MBTCP.STATUS.Block.Write	Total number of write blocks transferred from the processor to the module
MBTCP.STATUS.Block.Parse	Total number of blocks successfully parsed that were received from the processor
MBTCP.STATUS.Block.Event	Total number of event command blocks received from the processor
MBTCP.STATUS.Block.Cmd	Total number of command blocks received from the processor
MBTCP.STATUS.Block.Err	Total number of block transfer errors recognized by the module

5.3.4.2 MBTCP.STATUS.ClientStatus

This array contains the status of a specific MBTCP Client (0 – 9).

Tag Name	Description
MBTCP.STATUS.ClientStatus.Request	Initiates request for Client Status block from module when set to 1
MBTCP.STATUS.ClientStatus.ClientID	Specifies Client (0 - 9) to request status data from
MBTCP.STATUS.ClientStatus.CommandRequests	Total number of requests made from this port to server devices on the network
MBTCP.STATUS.ClientStatus.CommandResponses	Total number of server response messages received on the port
MBTCP.STATUS.ClientStatus.CommandErrors	Total number of command errors processed on the port. These errors could be due to a bad response or command
MBTCP.STATUS.ClientStatus.Requests	Total number of messages sent out of the port
MBTCP.STATUS.ClientStatus.Responses	Total number of messages received on the port
MBTCP.STATUS.ClientStatus.ErrorsSent	Total number of message errors sent out of the port
MBTCP.STATUS.ClientStatus.ErrorsReceived	Total number of message errors received on the port
MBTCP.STATUS.ClientStatus.ConfigErrorWord	Bitmap indicating general module configuration errors
MBTCP.STATUS.ClientStatus.CurrentError	Most recent error code recorded for the Client
MBTCP.STATUS.ClientStatus.LastError	Previous most recent error code recorded for the Client
MBTCP.STATUS.ClientStatus.CmdErrors[x]	Command error code for each command (0-15) on the specified Client's command list

5.3.4.3 MBTCP.STATUS.EventSeqStatus

This array contains the status of the event command queue.

Tag Name	Description
MBTCP.STATUS.EventSeqStatus.ClientID	Specifies Client (0 - 9) to request event status data from
MBTCP.STATUS.EventSeqStatus.MessageCount	Number of Event Sequence Messages in block (0 to15)
MBTCP.STATUS.EventSeqStatus.SeqNum_RetErrCode[x]	Sequence Number returned Error Code

5.3.4.4 MBTCP.STATUS.EventSeqCounts

This array indicates the number of commands waiting in the command queue.

Tag Name	Description
MBTCP.STATUS.EventSeqCounts.ClientCmdCount_EventSeqMessage[x]	Event command quantity waiting in queue There are two bytes of status data per Client. See below for more details.

Byte 1: Number of Event sequence commands for which status has not yet been retrieved (up to 15). This corresponds to the MNETC.STATUS.EventSeqCmdPending.Client[x]_QueueCount controller tag.

Byte 2: Total number of commands waiting in the command queue. This includes Event Commands, Event Commands with Sequence Numbers, and Command Control messages. This corresponds to the *MBTCP.STATUS.EventSeqStatus.MessageCount* controller tag.

5.3.4.5 MBTCP.STATUS.GeneralStatus

This array contains the general status of the module including firmware revision and general communication status.

Tag Name	Description
MBTCP.STATUS.GeneralStatus. ExpectedWriteBlock	Contains the next write block ID number
MBTCP.STATUS.GeneralStatus. ProgramScanCount	Program cycle counter – increments each time a complete program cycle occurs in the module
MBTCP.STATUS.GeneralStatus. ProductCode	Product code
MBTCP.STATUS.GeneralStatus. ProductVersion	Firmware revision level number
MBTCP.STATUS.GeneralStatus. OperatingSystem	Operating level number
MBTCP.STATUS.GeneralStatus. RunNumber	Run number
MBTCP.STATUS.GeneralStatus. ReadBlockCount	Total number of read blocks transferred from the module to the processor
MBTCP.STATUS.GeneralStatus. WriteBlockCount	Total number of write blocks transferred from the processor to the module
MBTCP.STATUS.GeneralStatus. ParseBlockCount	Total number of blocks successfully parsed that were received from the processor
MBTCP.STATUS.GeneralStatus. CmdEventBlockCount	Total number of event command blocks received from the processor
MBTCP.STATUS.GeneralStatus. CmdBlockCount	Total number of command blocks received from the processor
MBTCP.STATUS.GeneralStatus. ErrorBlockCount	Total number of block transfer errors recognized by the module
MBTCP.STATUS.GeneralStatus. Client0CmdExecutionWord	Each bit in this word is used to enable/disable the commands for client 0. 0=Disable, 1=Enable
MBTCP.STATUS.GeneralStatus. Client1to9CmdExecutionWord	Each bit in each of the 10 words is used to enable/disable the commands for Clients 1 to 9. 0=Disable, 1=Enable
MBTCP.STATUS.GeneralStatus. EventSeqReady	Bit mapped (1 bit per client 0 - 9) Bit=0, no event sequence status data ready Bit=1, event sequence status data ready
MBTCP.STATUS.GeneralStatus. MNetRequestCount	Increments each time an encapsulated Modbus TCP/IP (Service port 2000) request is received.
MBTCP.STATUS.GeneralStatus. MNetResponseCount	Increments each time an encapsulated Modbus TCP/IP (Service port 2000) response message is sent.
MBTCP.STATUS.GeneralStatus. MnetErrorSent	Increments each time an error is sent from a server on service port 2000.
MBTCP.STATUS.GeneralStatus. MNETErrorReceived	Increments each time an error is received from a server on service port 2000.
MBTCP.STATUS.GeneralStatus. MBAPRequestCount	Increments each time a MBAP (Service port 502) request is received.
MBTCP.STATUS.GeneralStatus. MBAPResponseCount	Increments each time a MBAP (Service port 502) response message is sent.
MBTCP.STATUS.GeneralStatus. MBAPErrorSent	Increments each time an error is sent from the server on service port 502.
MBTCP.STATUS.GeneralStatus. MBAPErrorReceived	Increments each time an error is received from a server on service port 502.

5.3.4.6 MBTCP.STATUS.GetEventDataStatus

This array contains the status of the event command last executed.

Tag Name	Description
MBTCP.STATUS.GetEventData Status.ClientRecordsCount	Number of clients contained in block
MBTCP.STATUS.GetEventData Status.Status	Two words per Client. Word 1= Client (0 - 9) Word 2= Error code for last executed command for corresponding client

5.3.5 MBTCP.UTIL

The array is used for internal ladder processing. It should not be modified.

Tag Name	Description
MBTCP.UTIL.ReadDataSizeGet	Read Block transfer size (240)
MBTCP.UTIL.WriteDataSizeGet	Write Block transfer size (240)
MBTCP.UTIL.ReadDataBlkCount	Number of Read Data blocks (1)
MBTCP.UTIL.WriteDataBlkCount	Number of Write Data blocks (1)
MBTCP.UTIL.RBTSremainder	Not used for this module
MBTCP.UTIL.WBTSremainder	Not used for this module
MBTCP.UTIL.BlockIndex	Not used for this module
MBTCP.UTIL.LastRead	Latest Read Block ID received from the module. (0 or 1)
MBTCP.UTIL.LastWrite	Latest Write Block ID to be sent to the module. (0 or 1)
MBTCP.UTIL.LastWriteInit	Latest Write Block ID used during initialization
MBTCP.UTIL.ConfigFile [ ] Array	Holds variables for configuration file transfer
MBTCP.UTIL.ConfigFile.WordLength	Length of configuration data to be included in block transfer
MBTCP.UTIL.ConfigFile.BlockCount	Block transfer count for transferring the whole configuration file from PLC to the Module
MBTCP.UTIL.ConfigFile.FileOffset	Offset in configuration file to use as a starting point for copying over configuration data
MBTCP.UTIL.ConnectionInputSize	Size of Connection Input array (242)
MBTCP.UTIL.BlockTransferSize	Size of backplane transfer blocks (240)
MBTCP.UTIL.SlotNumber	Slot number of the module in the rack
MBTCP.UTIL.CommandControlPending	Waiting for response from module
MBTCP.UTIL.CommandControlWrite BlockID	Block ID for Command Control
MBTCP.UTIL.EventCommandDBData Pending	Keeps an Event Command with Data message from being sent to the module before the previous Event Command with Data is completed
MBTCP.UTIL.EventCmd_DBData BlockID	Block ID of last read block
MBTCP.UTIL.EventCmd_DBDataWrite EventBlockID	Event response write block ID.
MBTCP.UTIL.EventCmd_Processor	Event Command Processor Data

DataPending	Pending – Yes (0) or No (1)
MBTCP.UTIL.EventCmd_Processor DataBlockID	Event Command processor data block ID
MBTCP.UTIL.EventSeqCmdPending	Event Sequence Command Pending – Yes (0) or No (1)
MBTCP.UTIL.EventSeqCmdBlockID	Event Sequence Command Block ID
MBTCP.UTIL.EventSeqCmdWriteEvent BlockID	Event Sequence Command Write Event Block ID
MBTCP.UTIL.PassThrough Array	Holds variables used for processing pass-through messages
MBTCP.UTIL.ClientServerControl BlockID	Client and Server Control Block ID
MBTCP.UTIL.ClientStatusPending	Client Status Pending – Yes (0) or No (1)
MBTCP.UTIL.ClientStatusWriteBlockID	Client Status Write Block ID
MBTCP.UTIL.EventSeqStatusPending	Event Sequence Status Pending – Yes (0) or No (1)
MBTCP.UTIL.EventSeqStatusWrite BlockID	Event Sequence Status Write Block ID
MBTCP.UTIL.EventSeqCountsWrite BlockID	Event Sequence Counts Write Block ID
MBTCP.UTIL.EventSeqCountsPending	Event Sequence Counts Pending – Yes (0) or No (1)
MBTCP.UTIL.TimeWriteBlockID	Time Write Block ID
MBTCP.UTIL.ResetStatusWriteBlockID	Reset Status Write Block ID
MBTCP.UTIL.GetEventDataStatus BlockID	Get Event Data Status Block ID

6 Diagnostics and Troubleshooting

In This Chapter

- Ethernet LED Indicators 9291
- LED Status Indicators 92
- Connecting the PC to the Module's Ethernet Port 94
- Using the Diagnostics Menu in ProSoft Configuration Builder 97
- Communication Error Codes 103

The module provides information on diagnostics and troubleshooting in the following forms:

- LED status indicators on the front of the module provide information on the module's status.
- Status data contained in the module can be viewed in *ProSoft Configuration Builder* through the Ethernet port.
- Status data values are transferred from the module to the processor.

6.1 Ethernet LED Indicators

The Ethernet LEDs indicate the module's Ethernet port status as follows:

LED	State	Description
Data	OFF	Ethernet connected at 10Mbps duplex speed
	AMBER Solid	Ethernet connected at 100Mbps duplex speed
Link	OFF	No physical network connection is detected. No Ethernet communication is possible. Check wiring and cables.
	GREEN Solid or Blinking	Physical network connection detected. This LED must be ON solid for Ethernet communication to be possible.

6.2 LED Status Indicators

ETH	CFG
CLT	BP
SRV	OK

The LEDs indicate the module's operating status.

LED	Color	Indication
ETH	Green	Application is running and Ethernet is ready
	Off	Application is not running
CLT	Red	Exception response received from the server; bad address, command, etc.
SRV	Red	Exception message received from the client
CFG	Red	Error in configuration
	Green	Configuration is OK
	Amber	Configuration state
	Off	Application is not running or backplane has failed
BP	Red	Processor is not in RUN mode
	Green	(Flashing) BP transfer is operational
	Amber	Initialization state
	Off	Application is not running
OK	Red	Application is not running
	Green	Application is running

During module configuration, the OK LED will be red and the BP LED will be on. If the BP ACT and OK LEDs blink at a rate of every one-second, this indicates a serious problem with the module. Call ProSoft Technology technical support to arrange for repairs.

6.2.1 Clearing a Fault Condition

Typically, if the OK LED on the front of the module remains RED for more than ten seconds, a hardware problem has been detected or the program has exited.

To clear the condition, follow these steps:

1. Turn off power to the rack.
2. Remove the card from the rack.
3. Verify all jumpers are set correctly.
4. Re-insert the card in the rack and turn the power back on.
5. Verify correct configuration data is being transferred to the module from the CompactLogix controller.

If the module's OK LED does not turn GREEN, verify that the module is inserted completely into the rack. If this does not cure the problem, contact ProSoft Technology Technical Support.

6.2.2 Troubleshooting the LEDs

Use the following troubleshooting steps if problems occur when the module is powered up. If these steps do not resolve the problem, please contact ProSoft Technology Technical Support.

Processor Errors

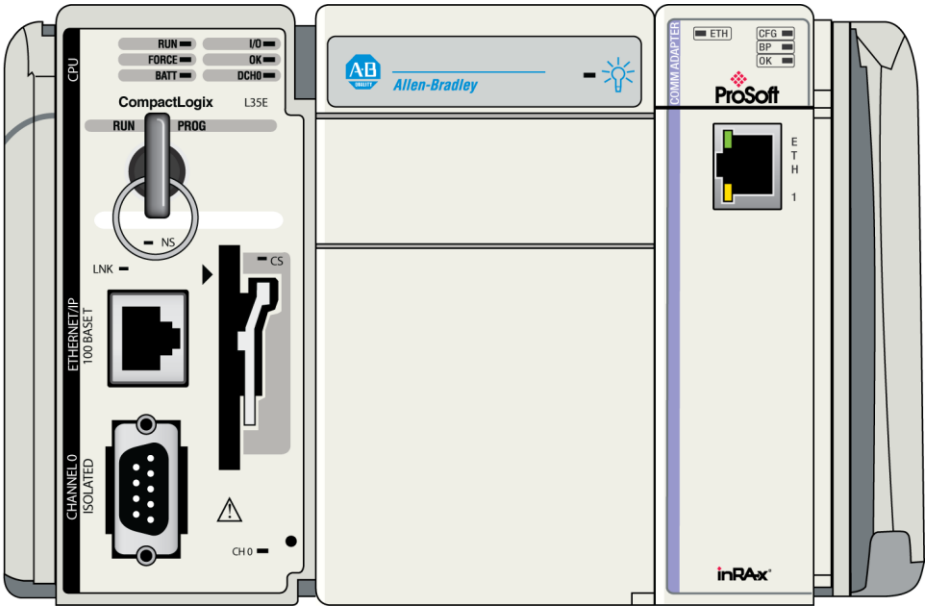
Problem Description	Steps to take
Processor Fault	Verify the module is securely plugged into the slot that has been configured for it in the I/O Configuration of RSLogix. Verify the slot location in the rack has been configured correctly in the ladder logic.
Processor I/O LED flashes	This indicates a problem with backplane communications. A problem could exist between the processor and any installed I/O module, not just the MVI69L-MBTCP. Verify all modules in the rack are configured correctly.

Module Errors

Problem Description	Steps to take
BP LED remains OFF or blinks slowly	This indicates that backplane transfer operations are failing. Connect to the module's Configuration/Debug port to check this. To establish backplane communications, verify the following items: ▪ The processor is in RUN or REM RUN mode. ▪ The backplane driver is loaded in the module. ▪ The module is configured for read and write data block transfer. ▪ The ladder logic handles all read and write block situations. ▪ The module is properly configured in the processor I/O configuration and ladder logic.
OK LED remains Red	The program has halted or a critical error has occurred. Connect to the communication port to see if the module is running. If the program has halted, turn off power to the rack, remove the card from the rack and re-insert the card in the rack, and then restore power to the rack.

6.3 Connecting the PC to the Module's Ethernet Port

With the module securely mounted, connect one end of the Ethernet cable to the ETH1 Port, and the other end to an Ethernet hub or switch accessible from the same network as the PC. Or, connect directly from the Ethernet Port on the PC to the **ETH 1** Port on the module.

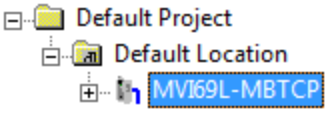


6.3.1 Setting Up a Temporary IP Address

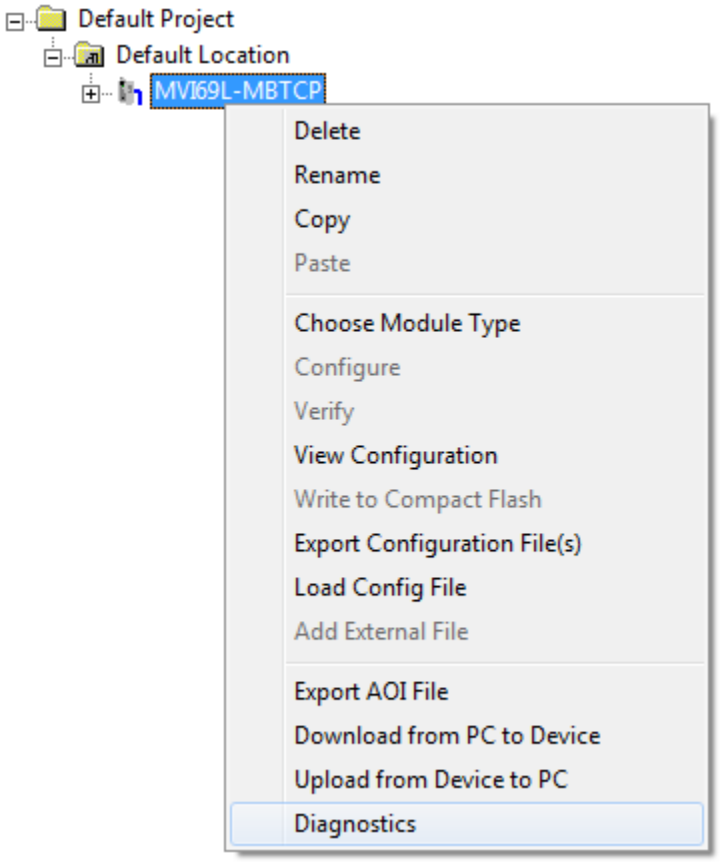
Important: *ProSoft Configuration Builder* locates MVI69L-MBTCP modules through UDP broadcast messages. These messages may be blocked by routers or layer 3 switches. In that case, *ProSoft Discovery Service* will be unable to locate the modules.

To use *ProSoft Configuration Builder*, arrange the Ethernet connection so that there is no router/ layer 3 switch between the computer and the module, OR reconfigure the router/ layer 3 switch to allow routing of the UDP broadcast messages.

1 In the tree view in *ProSoft Configuration Builder (PCB)*, select the **MVI69L-MBTCP** module. (For instructions on opening and using a project in PCB, please refer to Chapter 2.)

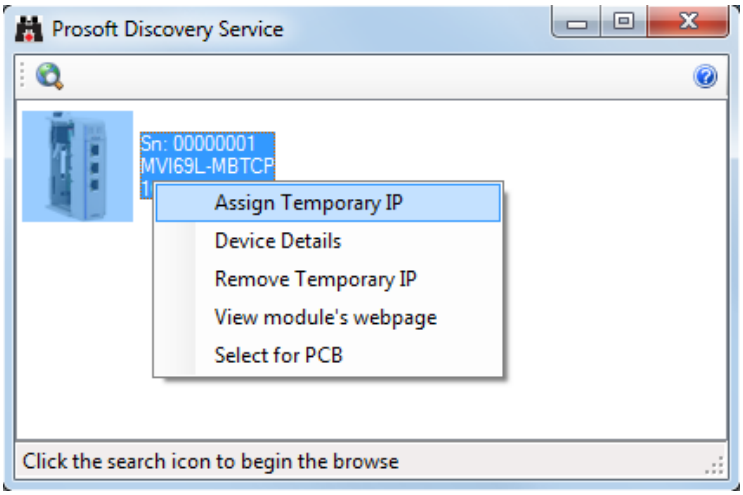


2 Click the right mouse button to open a shortcut menu. On the shortcut menu, choose **DIAGNOSTICS.**

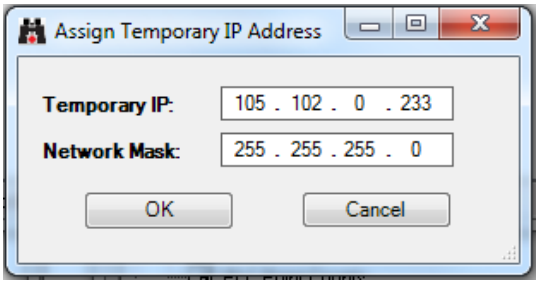


3 In the *Diagnostics* window, click the **SET UP CONNECTION** button.

4 In the *Connection Setup* dialog box, click the **BROWSE DEVICE(S)** button to open the *ProSoft Discovery Service*. Select the module, then right-click and choose **ASSIGN TEMPORARY IP**.



5 The module's default IP address is usually 192.168.0.250. Choose an unused IP within your subnet, and then click **OK**.



Important: The temporary IP address is only valid until the next time the module is initialized. For information on how to set the module's permanent IP address, see page 58.

6 Close the *ProSoft Discovery Service* window. Enter the temporary IP address in the Ethernet address field of the *Connection Setup* dialog box, then click the **TEST CONNECTION** button to verify that the module is accessible with the current settings.

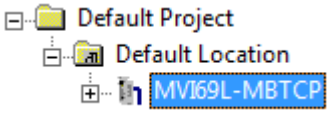
7 If the *Test Connection* is successful, click **CONNECT**. The *Diagnostics* menu will display in the *Diagnostics* window. At this point, the module has been established on the Ethernet network with a unique IP address.

6.4 Connecting to the Diagnostics Menu in ProSoft Configuration Builder

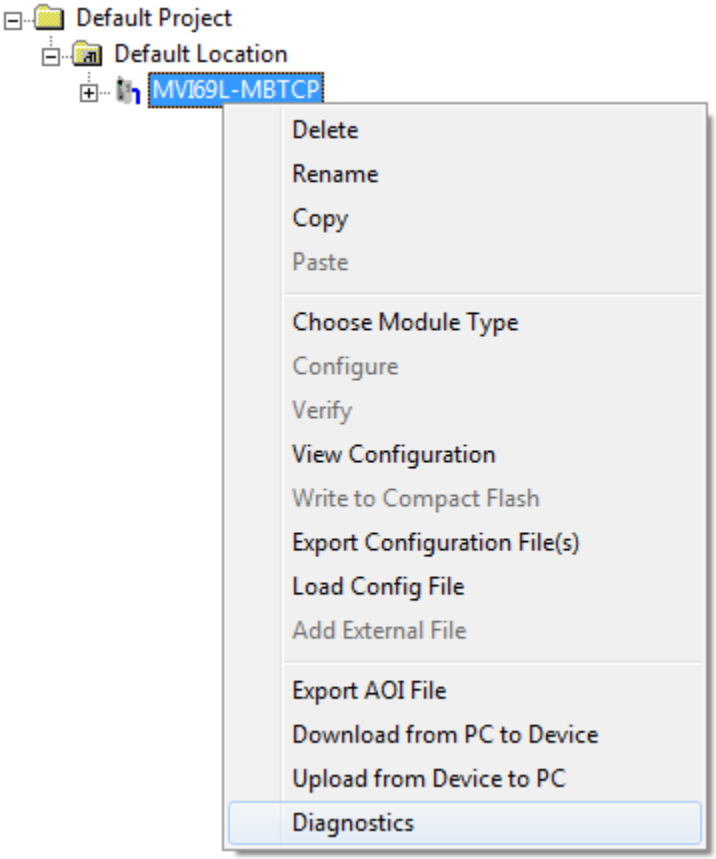
ProSoft Configuration Builder (PCB) provides diagnostic menus for debugging and troubleshooting.

To connect to the module's Configuration/Debug Ethernet port

1 In *ProSoft Configuration Builder*, select the module, and then click the right mouse button to open a shortcut menu.

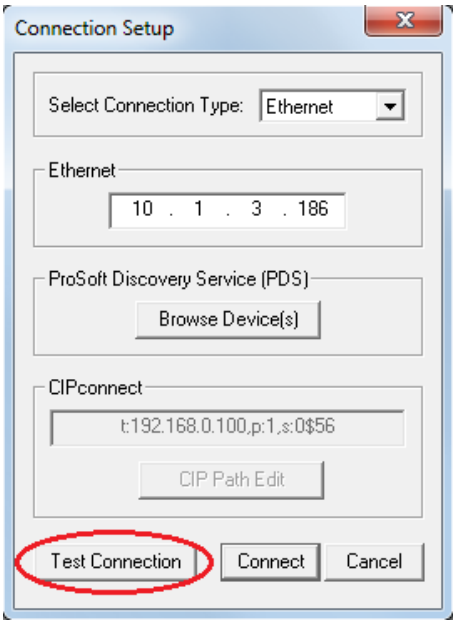


2 On the shortcut menu, choose **DIAGNOSTICS.**



3 After the *Diagnostics* window opens, click the **SETUP CONNECTION** button to browse for the module's IP address.

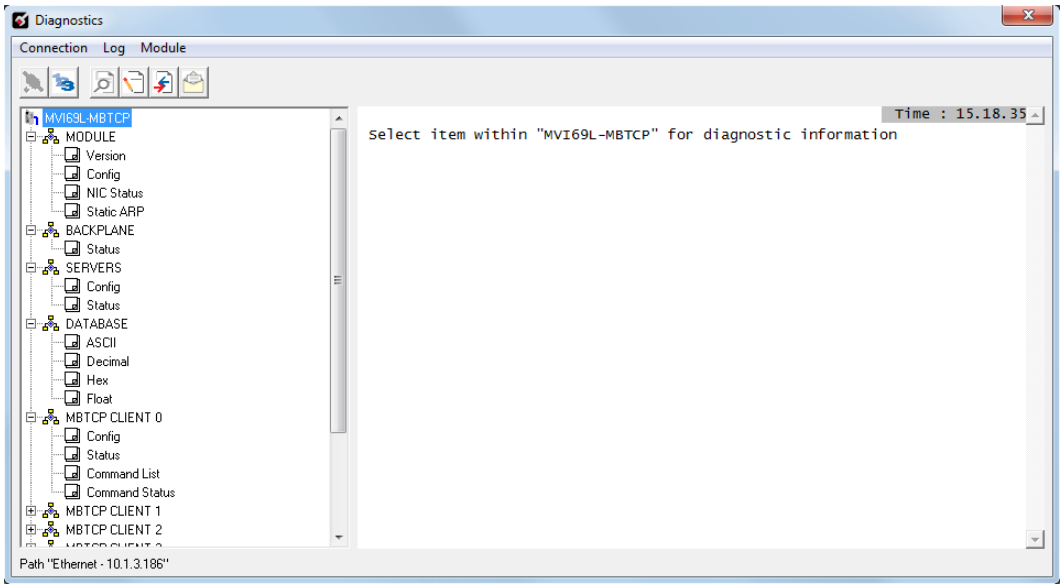
4 In the *Ethernet* field of the *Connection Setup* dialog box, enter the current IP address, whether it is temporary or permanent. Click the **TEST CONNECTION** button to verify that the module is accessible with the current settings.



5 If the *Test Connection* is successful, click **CONNECT**. The *Diagnostics* window is now accessible.

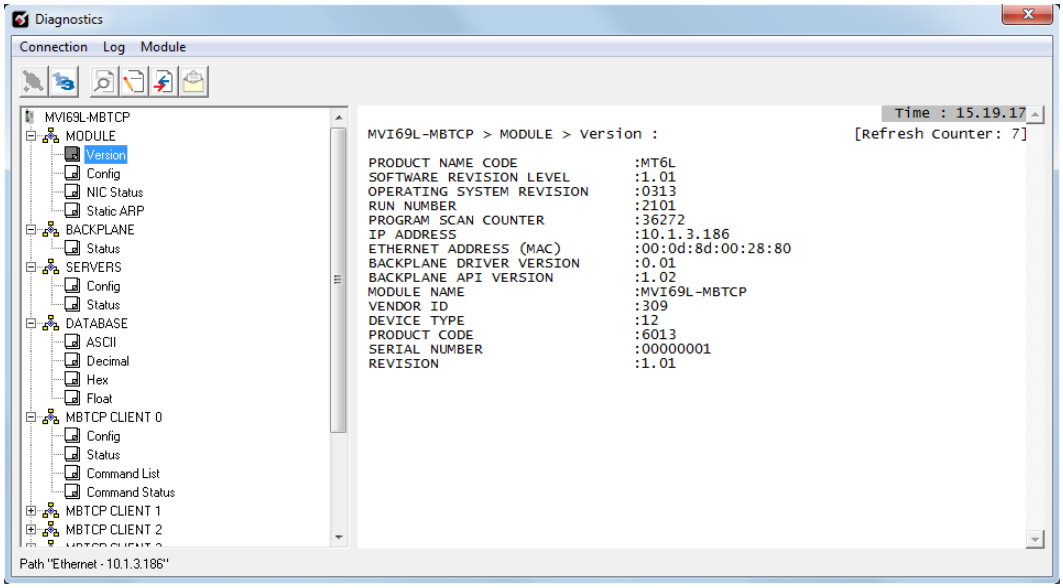
6.4.1 Diagnostics Menu

The *Diagnostics* menu is available through the Ethernet configuration port. The menu is arranged as a tree structure.



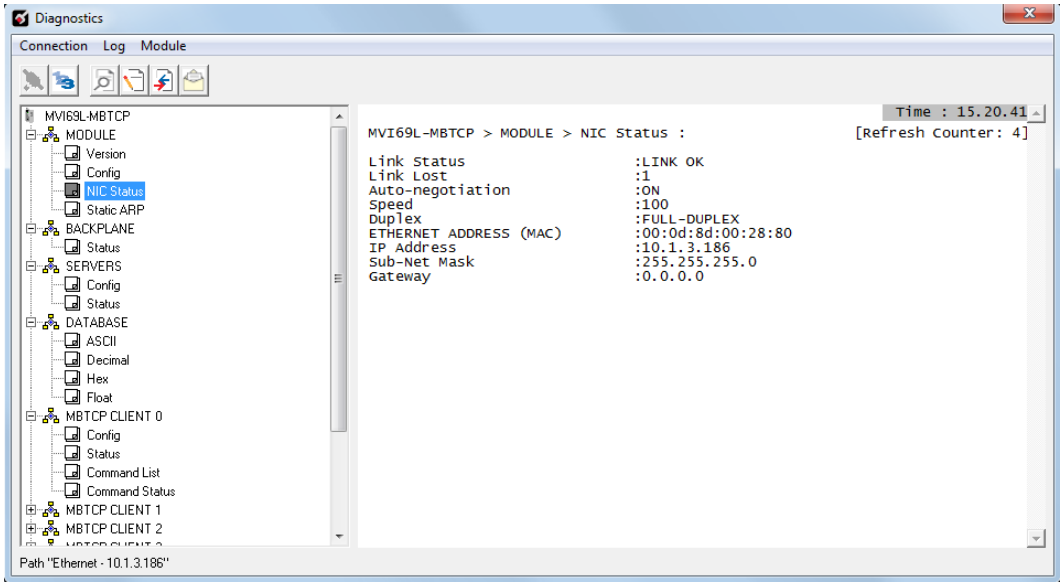
6.4.2 Monitoring General Information

Use the MODULE>Version menu to view module version information.



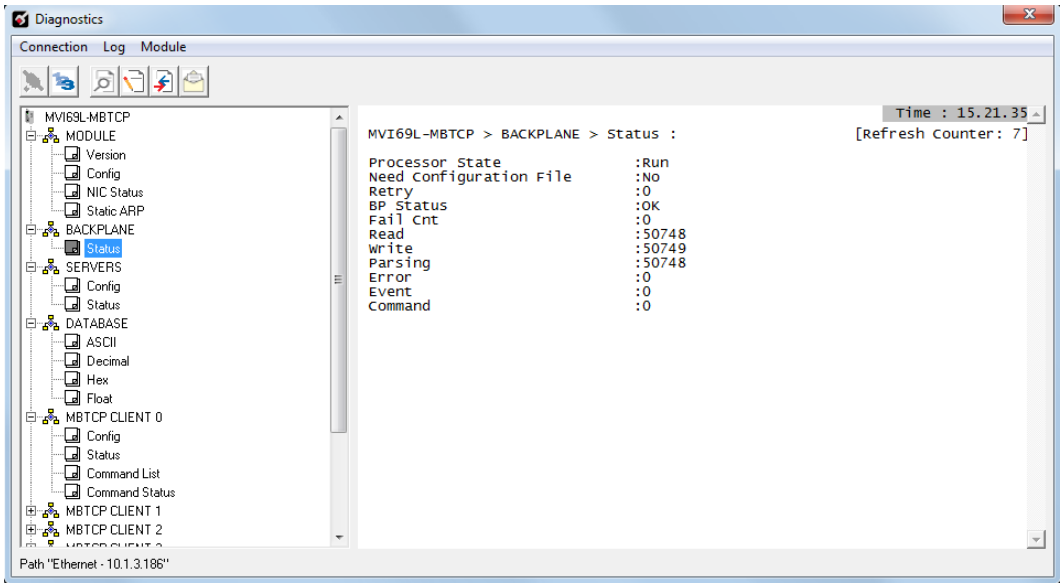
6.4.3 Monitoring Network Configuration Information

Use the MODULE>NIC Status menu to view the Ethernet network configuration information.



6.4.4 Monitoring Backplane Status Information

Use the BACKPLANE>Status menu to view the backplane information.

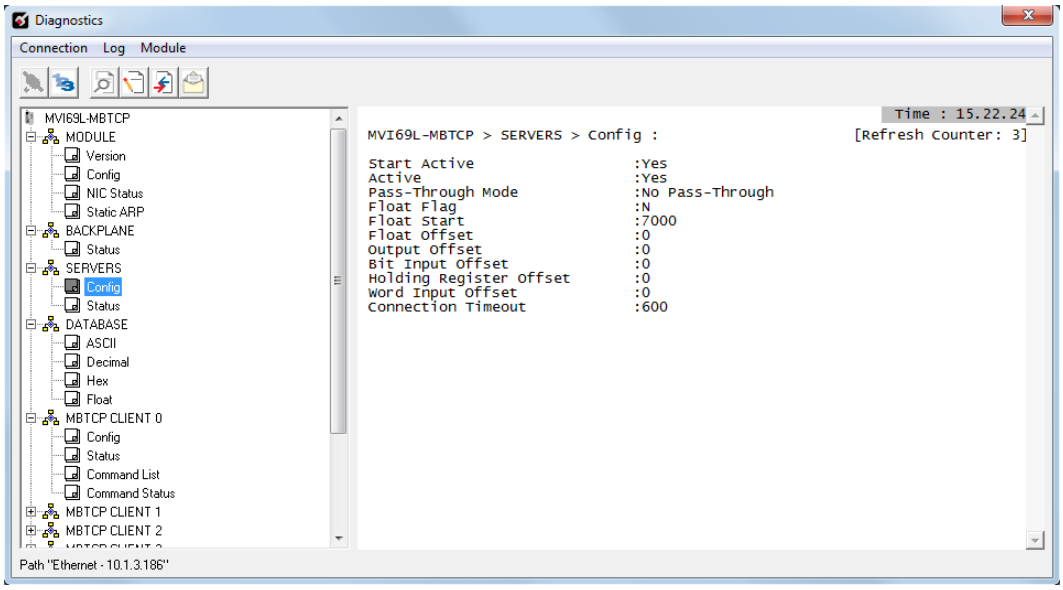


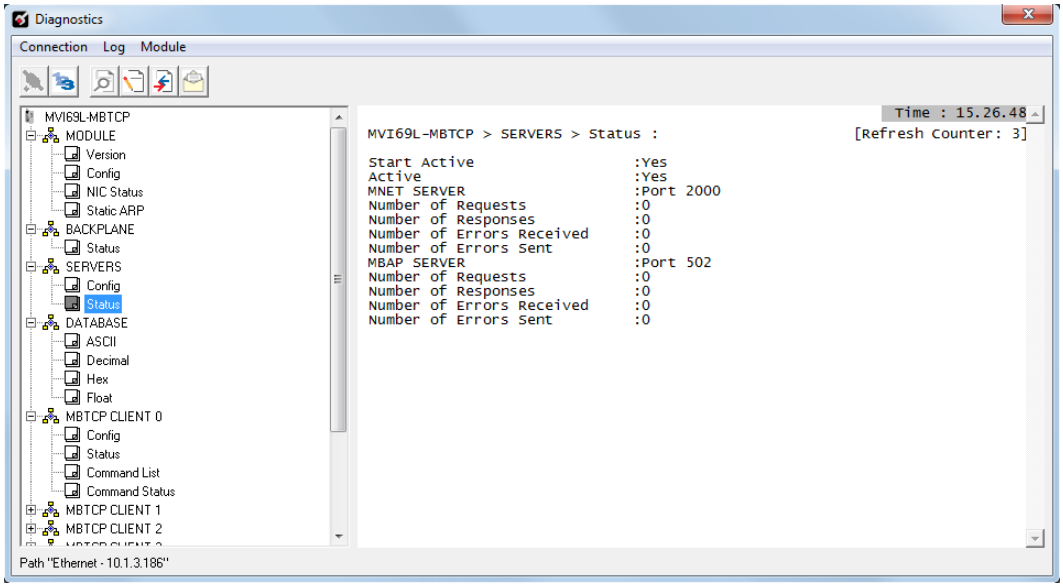
6.4.5 Modbus Server Driver Information

The SERVERS menu includes the following submenus:

-Module Server Configuration

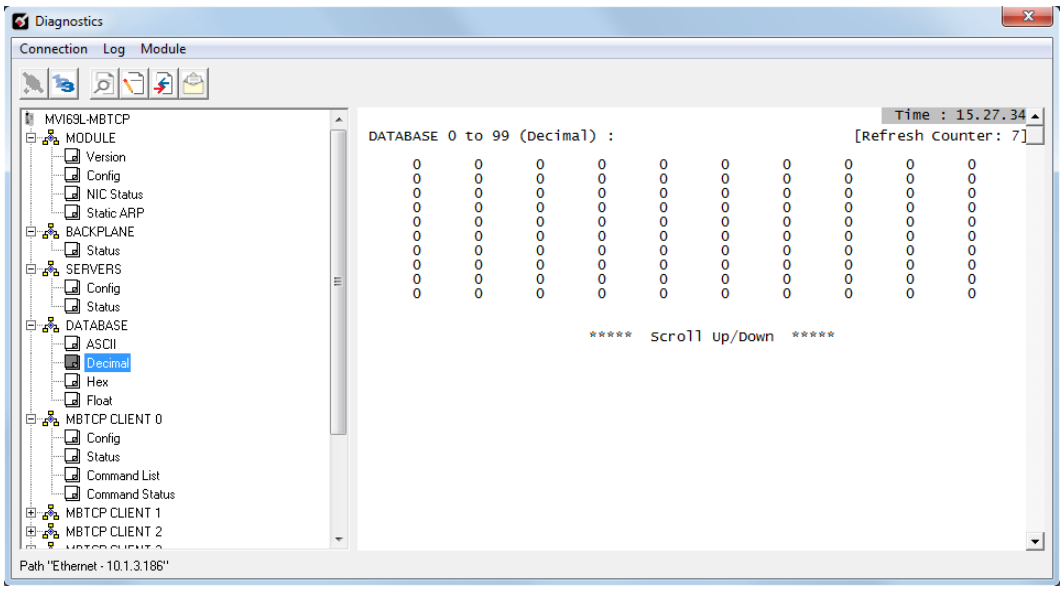
-Module Server Status





6.4.6 Monitoring Data Values in the Module's Database

Use the DATABASE>Decimal menu to view the contents of the MVI69L-MBTCP module's internal database. Data values can also be viewed in ASCII, Hexadecimal, and Float format.



6.4.7 Modbus Client Driver Information

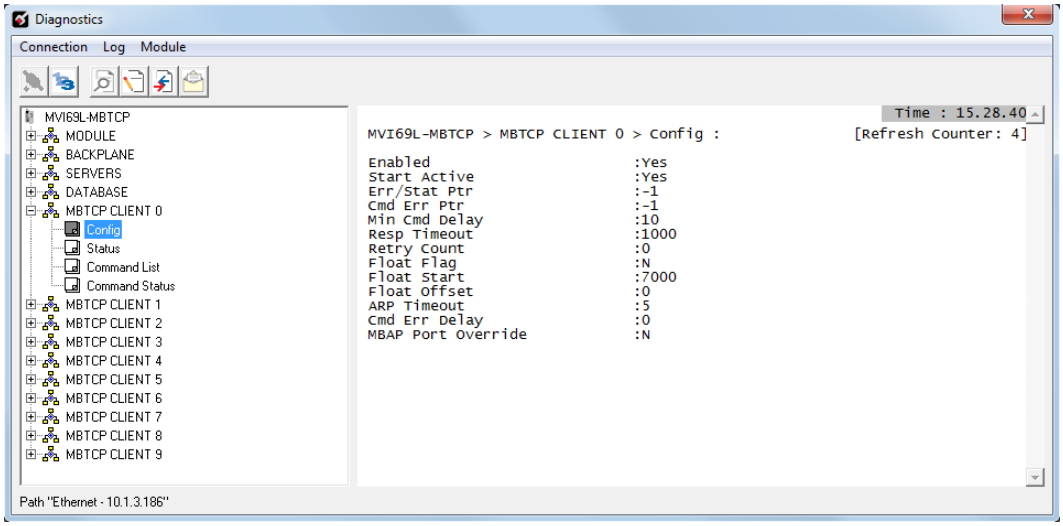
The MBTCP CLIENT X menus include the following submenus:

-Client x Configuration

-Client x Status

-Client x Command List

-Client x Command Status



6.5 Communication Error Codes

Standard Modbus Protocol Exception Code Errors

Code	Description
1	Illegal Function Code
2	Illegal Data Address
3	Illegal Data Value
4	Failure in Associated Device
5	Acknowledge
6	Busy, Rejected Message

Module Communication Error Codes

Code	Description
-1	CTS modem control line not set before transmit
-2	Timeout while transmitting message
-11	Timeout waiting for response after request
253	Incorrect slave address in response
254	Incorrect function code in response
255	Invalid CRC/LRC value in response

Command List Entry Errors

Code	Description
-41	Invalid enable code
-42	Internal address > maximum address
-43	Invalid node address (< 0 or > 255)
-44	Count parameter set to 0
-45	Invalid function code
-46	Invalid swap code

MBTCP Client-Specific Errors

Code	Description
-33	Failed to connect to server specified in command
-36	MBTCP command response timeout
-37	TCP/IP connection ended before session finished

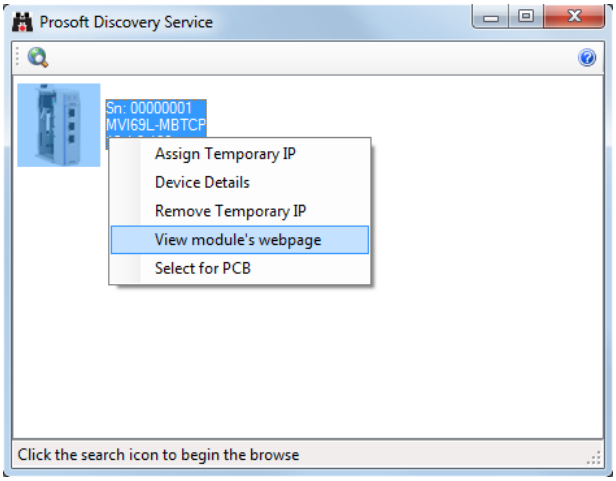
Note: If an error code is reported that is not listed above, check with the documentation of the end device. Device-specific error codes can be produced by the end device.

6.6 Connecting to the Module's Webpage

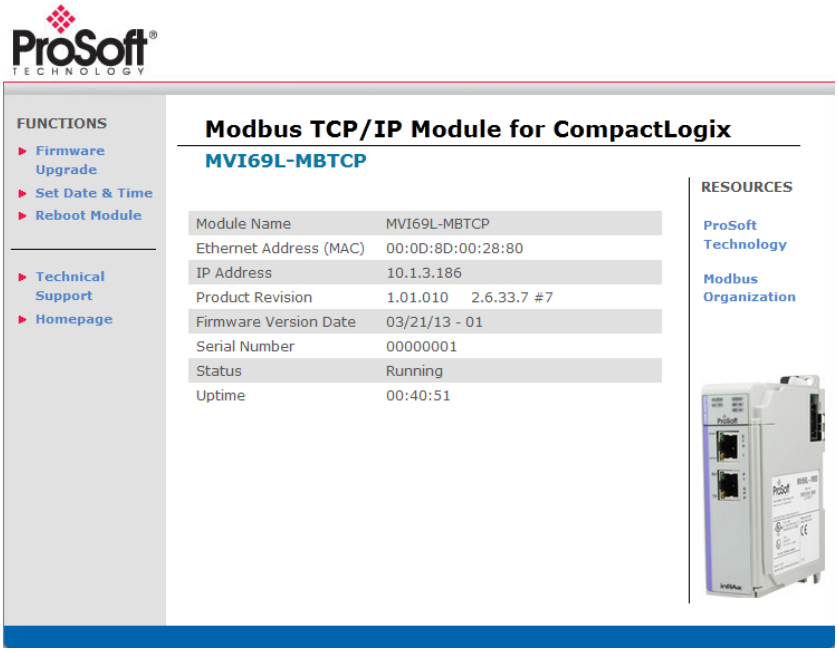
The module's internal web server provides access to module version and status information, as well as the ability to set the date and time, reboot the module, and download firmware upgrade to the module. Once an IP address has been assigned to the module, access to the webpage can be done in a web browser.

Connectivity can also be done using *ProSoft Discovery Service* in PCB Connection Setup menu shown below.

1 In *ProSoft Discovery Service*, right-click the icon to open a shortcut menu.



2 On the shortcut menu, choose **VIEW MODULE'S WEBPAGE**. It will launch your default web browser and open the webpage.



7 Reference

In This Chapter

- Product Specifications 106
- About the Modbus Protocol 108
- Floating-Point Support 120
- Function Blocks 126
- Cable Connections 148

7.1 Product Specifications

The MVI69L-MBTCP (Modbus TCP/IP Communication Module) allows Rockwell Automation CompactLogix I/O compatible processors to interface easily with other Modbus TCP/IP protocol compatible devices.

The module acts as an input/output communications module between the Modbus TCP/IP network and the CompactLogix backplane. The data transfer from the CompactLogix processor is asynchronous from the actions on the Modbus TCP/IP network. Databases are user-defined and stored in the module to hold the data required by the protocol.

- Single-slot, 1769 backplane-compatible
- Ladder Logic is used for data transfer between module and processor. Sample Add-On Instruction file included.
- Configuration data obtained from and stored in the processor.
- Supports CompactLogix processors with 1769 I/O bus capability and at least 500 mA of 5 Vdc backplane current available.

7.1.1 General Specifications - Modbus Client/Server

Specification	Description
Communication parameters	Supports Modbus MBAP and encapsulated (Server) messaging 10/100 Base-T Ethernet-compatible interface
Modbus Modes	Client driver supports up to ten connections for active reading and writing of data with Modbus TCP/IP compatible devices Server driver supports connections to up to five Modbus TCP/IP Clients using Service Port 502 with standard MBAP messaging, and up to five Clients using Modbus RTU/ASCII on Service Port 2000 (and others)
Floating Point Data	Floating point data movement supported, including configurable support for Enron, Daniel®, and other implementations
Modbus Function Codes Supported	1: Read Coil Status 2: Read Input Status 3: Read Holding Registers 4: Read Input Registers 5: Force (Write) Single Coil 6: Preset (Write) Single Holding Register 8: Diagnostics (Server Only, Responds to Subfunction 00) 15: Force(Write) Multiple Coils 16: Preset (Write) Multiple Holding Registers 17: Report Server ID (Server Only) 22: Mask Write Holding Register (Server Only) 23: Read/Write Holding Registers (Server Only)

7.1.2 Hardware Specifications

Specification	Description
Dimensions	Standard 1769 Single-slot module
Current Load	500 mA max @ 5 VDC Power supply distance rating of 4 (L43 and L45 installations on first 2 slots of 1769 bus)
Operating Temp.	32° F to 140° F (0° C to 60°C)
Storage Temp.	-40° F to 185° F (-40° C to 85° C)
Relative Humidity	5% to 95% (with no condensation)
LED Indicators	Module OK Status Backplane Activity Ethernet Port Activity Configuration Activity
Application/Diagnostics Port (ETH 1)	Diagnostics over Ethernet connection RJ45 Port
Shipped with Unit	DVD-001 Product DVD RL-CBL025 Ethernet straight-though cable

7.2 About the Modbus Protocol

Modbus is a widely-used protocol originally developed by Modicon in 1978. Since that time, the protocol has been adopted as a standard throughout the automation industry.

Modbus TCP/IP is a Client/Server protocol. The Client establishes a connection to the remote Server. When the connection is established, the Client sends the Modbus commands to the Server. The MVI69L-MBTCP module can work as a Client and as a Server.

The MVI69L-MBTCP module also works as an input/output module between itself and the Rockwell Automation backplane and processor. The module uses an internal database to pass data and commands between the processor and Client and Server devices on Modbus networks.

Modbus Client

The MVI69L-MBTCP Modbus Client actively issues Modbus commands to Modbus servers on the Modbus TCP/IP network, supporting up to 16 commands for each Client. The Clients have an optimized polling characteristic that polls servers with communication problems less frequently.

Command List	Up to 16 commands per Client, each fully configurable for function, server IP address, register to/from addressing and word/bit count.
Polling of command list	Configurable polling of command list, including continuous and on change of data, and dynamically user or automatic enabled.
Status Data	Error codes available on an individual command basis. In addition, a server status list is maintained per active Modbus Client.

Modbus Server

The MVI69L-MBTCP Modbus Server driver permits a remote Client to interact with all data contained in the module. This data can be derived from other Modbus server devices on the network, through a Client port, or from the CompactLogix processor.

Service Port	MBAP messaging on Service Port 502 Encapsulated messaging on Service Port 2000
Status Data	Error codes, counters and port status available

7.2.1 Commands Supported by the Module

The format of each command in the list depends on the Modbus Function Code being executed. The following table lists the Function Codes supported by the module.

Function Code	Definition	Supported as Client	Supported as Server
1	Read Coil Status 0x	X	X
2	Read Input Status 1x	X	X
3	Read Holding Registers 4x	X	X
4	Read Input Registers 3x	X	X
5	Set Single Coil 0x	X	X
6	Single Register Write 4x	X	X
8	Diagnostics		X
15	Multiple Coil Write 0x	X	X
16	Multiple Register Write 4x	X	X
17	Report Server ID		X
22	Mask Write 4X		X
23	Read/Write		X

Each command list record has the same general format. The first part of the record contains the information relating to the communication module and the second part contains information required to interface to the Modbus server device.

7.2.2 Read Coil Status (Function Code 01)

Query

This function allows the user to obtain the ON/OFF status of logic coils (Modbus 0x range) used to control discrete outputs from the addressed Server only. Broadcast mode is not supported with this function code. In addition to the Server address and function fields, the message requires that the information field contain the initial coil address to be read (Starting Address) and the number of locations that will be interrogated to obtain status data.

The addressing allows up to 2000 coils to be obtained at each request; however, the specific Server device may have restrictions that lower the maximum quantity. The coils are numbered from zero; (coil number 1 = zero, coil number 2 = one, coil number 3 = two, and so on).

The following table is a sample read output status request to read coils 0020 to 0056 (37 coils) from Server device number 11.

Note: This is the structure of the message being sent out to the Modbus network. The byte values below are in hexadecimal display

Node Address	Function Code	Data Start Point High	Data Start Point Low	Number of Points High	Number of Points Low	Error Check Field (2 bytes)
0B	01	00	13	00	25	CRC

Response

The data is packed one bit for each coil. The response includes the Server address, function code, quantity of data characters, the data characters, and error checking. Data will be packed with one bit for each coil (1 = ON, 0 = OFF). The low order bit of the first character contains the addressed coil, and the remainder follows. For coil quantities that are not even multiples of eight, the last characters will be filled in with zeros at high order end. The quantity of data characters is always specified as quantity of RTU characters, that is, the number is the same whether RTU or ASCII is used.

Because the Server interface device is serviced at the end of a controller's scan, data will reflect coil status at the end of the scan. Some Servers will limit the quantity of coils provided each scan; thus, for large coil quantities, multiple PC transactions must be made using coil status from sequential scans.

Node Address	Func Code	Byte Count	Data Coil Status 20 to 27	Data Coil Status 28 to 35	Data Coil Status 36 to 43	Data Coil Status 44 to 51	Data Coil Status 52 to 56	Error Check Field (2 bytes)
0B	01	05	CD	6B	B2	OE	1B	CRC

The status of coils 20 to 27 is shown as CD (HEX) = 1100 1101 (Binary). Reading from left to right, this shows that coils 27, 26, 23, 22, and 20 are all on. The other Data Coil Status bytes are decoded similarly. Due to the quantity of coil statuses requested, the last data field, which is shown 1B (HEX) = 0001 1011 (Binary), contains the status of only 5 coils (52 to 56) instead of 8 coils. The 3 left most bits are provided as zeros to fill the 8-bit format.

7.2.3 Read Input Status (Function Code 02)

Query

This function allows the user to obtain the ON/OFF status of discrete inputs (Modbus 1x range) in the addressed Server PC Broadcast mode is not supported with this function code. In addition to the Server address and function fields, the message requires that the information field contain the initial input address to be read (Starting Address) and the number of locations that will be interrogated to obtain status data.

The addressing allows up to 2000 inputs to be obtained at each request; however, the specific Server device may have restrictions that lower the maximum quantity. The inputs are numbered form zero; (input 10001 = zero, input 10002 = one, input 10003 = two, and so on, for a 584).

The following table is a sample read input status request to read inputs 10197 to 10218 (22 coils) from Server number 11.

Node Address	Function Code	Data Start Point High	Data Start Point Low	Number of Points High	Number of Points Low	Error Check Field (2 bytes)
0B	02	00	C4	00	16	CRC

Response

An example response to Read Input Status is as shown in Figure C4. The data is packed one bit for each input. The response includes the Server address, function code, quantity of data characters, the data characters, and error checking. Data will be packed with one bit for each input (1=ON, 0=OFF). The lower order bit of the first character contains the addressed input, and the remainder follows. For input quantities that are not even multiples of eight, the last characters will be filled in with zeros at high order end. The quantity of data characters is always specified as a quantity of RTU characters, that is, the number is the same whether RTU or ASCII is used.

Because the Server interface device is serviced at the end of a controller's scan, data will reflect input status at the end of the scan. Some Servers will limit the quantity of inputs provided each scan; thus, for large coil quantities, multiple PC transactions must be made using coil status for sequential scans.

Node Address	Func Code	Byte Count	Data Discrete Input 10197 to 10204	Data Discrete Input 10205 to 10212	Data Discrete Input 10213 to 10218	Error Check Field (2 bytes)
0B	02	03	AC	DB	35	CRC

The status of inputs 10197 to 10204 is shown as AC (HEX) = 10101 1100 (binary). Reading left to right, this show that inputs 10204, 10202, and 10199 are all on. The other input data bytes are decoded similar.

Due to the quantity of input statuses requested, the last data field which is shown as 35 HEX = 0011 0101 (binary) contains the status of only 6 inputs (10213 to 102180) instead of 8 inputs. The two left-most bits are provided as zeros to fill the 8-bit format.

7.2.4 Read Holding Registers (Function Code 03)

Query

This Function Code allows the user to obtain the holding registers (Modbus 4x range) in the addressed Server. The registers can store the numerical values of associated timers and counters which can be driven to external devices. The addressing allows up to 125 registers to obtain at each request; however, the specific Server device may have restrictions that lower this maximum quantity. The registers are numbered form zero (40001 = zero, 40002 = one, and so on). The broadcast mode is not allowed.

The example below reads registers 40108 through 40110 (3 registers) from Server ID 11.

Node Address	Function Code	Data Start Point High	Data Start Point Low	Number of Points High	Number of Points Low	Error Check Field (2 bytes)
0B	03	00	6B	00	03	CRC

Response

The addressed Server responds with its address and the function code, followed by the information field. The information field contains 1 byte describing the quantity of data bytes to be returned. The contents of the registers requested (DATA) are two bytes each, with the binary content right justified within each pair of characters. The first byte includes the high order bits and the second, the low order bits.

Because the Server interface device is normally serviced at the end of the controller's scan, the data will reflect the register content at the end of the scan. Some Servers will limit the quantity of register content provided each scan; thus for large register quantities, multiple transmissions will be made using register content from sequential scans.

In the example below, the registers 40108 to 40110 have the decimal contents 555, 0, and 100 respectively.

Node Address	Function Code	Byte Count	Hi Data	Lo Data	Hi Data	Lo Data	Hi Data	Lo Data	Error Check Field (2 bytes)
0B	03	06	02	2B	00	00	00	64	CRC

7.2.5 Read Input Registers (Function Code 04)

Query

This Function Code obtains the contents of the controller's input registers from the Modbus 3x range. These locations receive their values from devices connected to the I/O structure and can only be referenced, not altered from within the controller, The addressing allows up to 125 registers to be obtained at each request; however, the specific Server device may have restrictions that lower this maximum quantity. The registers are numbered for zero (30001 = zero, 30002 = one, and so on). Broadcast mode is not allowed.

The example below requests the contents of register 30009 in Server number 11.

Node Address	Function Code	Data Start Point High	Data Start Point Low	Number of Points High	Number of Points Low	Error Check Field (2 bytes)
0B	04	00	08	00	01	CRC

Response

The addressed Server responds with its address and the function code followed by the information field. The information field contains 1 byte describing the quantity of data bytes to be returned. The contents of the registers requested (DATA) are 2 bytes each, with the binary content right justified within each pair of characters. The first byte includes the high order bits and the second, the low order bits.

Because the Server interface is normally serviced at the end of the controller's scan, the data will reflect the register content at the end of the scan. Each PC will limit the quantity of register contents provided each scan; thus for large register quantities, multiple PC scans will be required, and the data provided will be form sequential scans.

In the example below the register 30009 contains the decimal value 0.

Node Address	Function Code	Byte Count	Data Input Register High	Data Input Register Low	Error Check Field (2 bytes)
0B	04	02	00	00	CRC

7.2.6 Force Single Coil (Function Code 05)

Query

This Function Code forces a single coil (Modbus 0x range) either ON or OFF. Any coil that exists within the controller can be forced to either state (ON or OFF). However, because the controller is actively scanning, unless the coil is disabled, the controller can also alter the state of the coil. Coils are numbered from zero (coil 0001 = zero, coil 0002 = one, and so on). The data value 65,280 (FF00 HEX) will set the coil ON and the value zero will turn it OFF; all other values are illegal and will not affect that coil.

The use of Server address 00 (Broadcast Mode) will force all attached Servers to modify the desired coil.

Note: Functions 5, 6, 15, and 16 are the only messages that will be recognized as valid for broadcast.

The example below is a request to Server number 11 to turn ON coil 0173.

Node Address	Function Code	Data Start Point High	Data Start Point Low	Number of Points High	Number of Points Low	Error Check Field (2 bytes)
0B	05	00	AC	FF	00	CRC

Response

The normal response to the Command Request is to re-transmit the message as received after the coil state has been altered.

Node Address	Function Code	Data Coil Point High	Data Coil Point Low	Data On/ Off	Data	Error Check Field (2 bytes)
0B	05	00	AC	FF	00	CRC

The forcing of a coil via MODBUS function 5 will be accomplished regardless of whether the addressed coil is disabled or not (*In ProSoft products,* the coil *is only affected if the necessary ladder logic is implemented).*

Note: The Modbus protocol does not include standard functions for testing or changing the DISABLE state of discrete inputs or outputs. Where applicable, this may be accomplished via device specific Program commands (*In ProSoft products, this is only accomplished through ladder logic programming).*

Coils that are reprogrammed in the controller logic program are not automatically cleared upon power up. Thus, if such a coil is set ON by function Code 5 and (even months later), an output is connected to that coil, the output will be "hot".

7.2.7 Preset Single Register (Function Code 06)

Query

This Function Code allows the user to modify the contents of a Modbus 4x range in the server. This will write to a single register only. Any holding register that exists within the controller can have its contents changed by this message. However, because the controller is actively scanning, it also can alter the content of any holding register at any time. The values are provided in binary up to the maximum capacity of the controller unused high order bits must be set to zero. When used with Server address zero (Broadcast mode) all Server controllers will load the specified register with the contents specified.

Note Functions 5, 6, 15, and 16 are the only messages that will be recognized as valid for broadcast.

The example below is a request to write the value '3' to register 40002 in server 11.

Node Address	Function Code	Data Start Point High	Data Start Point Low	Preset Data Register High	Preset Data Register Low	Error Check Field (2 bytes)
0B	06	00	01	00	03	CRC

Response

The response to a preset single register request is to re-transmit the query message after the register has been altered.

Node Address	Function Code	Data Register High	Data Register Low	Preset Data Register High	Preset Data Register Low	Error Check Field (2 bytes)
0B	06	00	01	00	03	CRC

7.2.8 Diagnostics (Function Code 08)

This Function Code provides a series of tests for checking the communication system between a Client device and a server, or for checking various internal error conditions within a server.

The function uses a two-byte sub-function code field in the query to define the type of test to be performed. The server echoes both the function code and sub-function code in a normal response. Some of the diagnostics commands cause data to be returned from the remote device in the data field of a normal response.

In general, issuing a diagnostic function to a remote device does not affect the running of the user program in the remote device. Device memory bit and register data addresses are not accessed by the diagnostics. However, certain functions can optionally reset error counters in some remote devices.

A server device can, however, be forced into 'Listen Only Mode' in which it will monitor the messages on the communications system but not respond to them. This can affect the outcome of your application program if it depends upon any further exchange of data with the remote device. Generally, the mode is forced to remove a malfunctioning remote device from the communications system.

Sub-function Codes Supported

Only Sub-function 00 is supported by the MVI69L-MBTCP module.

00 Return Query Data

The data passed in the request data field is to be returned (looped back) in the response. The entire response message should be identical to the request.

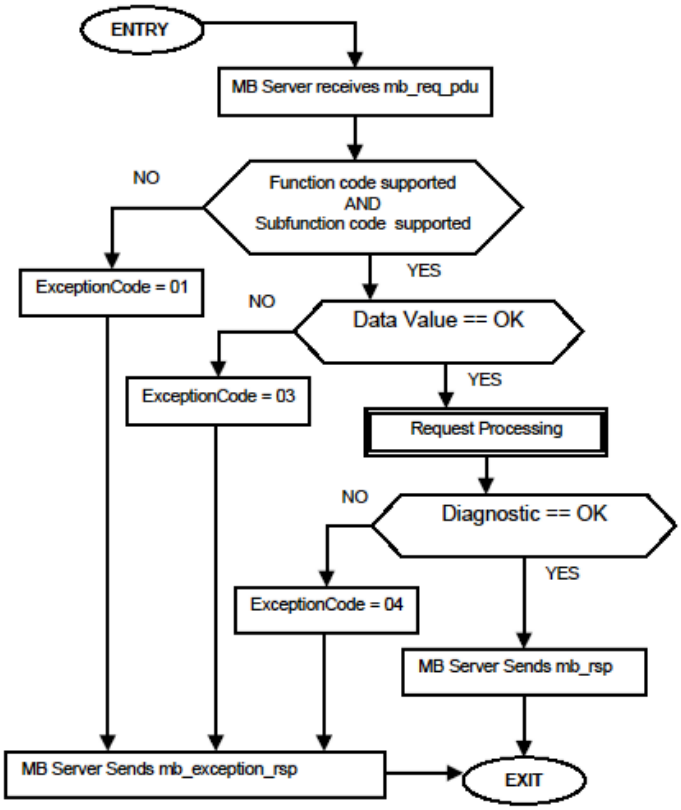
Sub-function	Data Field (Request)	Data Field (Response)
00 00	Any	Echo Request Data

Example and State Diagram

Here is an example of a request to remote device to Return Query Data. This uses a sub-function code of zero (00 00 hex in the two-byte field). The data to be returned is sent in the two-byte data field (A5 37 hex).

Request		Response	
Field Name	**(Hex)**	**Field Name**	**(Hex)**
Function	08	Function	08
Sub-function Hi	00	Sub-function Hi	00
Sub-function Lo	00	Sub-function Lo	00
Data Hi	A5	Data Hi	A5
Data Lo	37	Data Lo	27

The data fields in responses to other kinds of queries could contain error counts or other data requested by the sub-function code.



7.2.9 Force Multiple Coils (Function Code 15)

Query

This Function Code forces each coil (Modbus 0x range) in a consecutive block of coils to a desired ON or OFF state. Any coil that exists within the controller can be forced to either state (ON or OFF). However, because the controller is actively scanning, unless the coils are disabled, the controller can also alter the state of the coil. Coils are numbered from zero (coil 00001 = zero, coil 00002 = one, and so on). The desired status of each coil is packed in the data field, one bit for each coil (1= ON, 0= OFF). The use of Server address 0 (Broadcast Mode) will force all attached Servers to modify the desired coils.

Note: Functions 5, 6, 15, and 16 are the only messages (other than Loopback Diagnostic Test) that will be recognized as valid for broadcast.

The following example forces 10 coils starting at address 20 (13 HEX). The two data fields, CD =1100 and 00 = 0000 000, indicate that coils 27, 26, 23, 22, and 20 are to be forced on.

Node Address	Function Code	Coil Address High	Coil Address Low	Number of Coils High	Number of Coils Low	Byte Count	Force Data High 20 to 27	Force Data Low 28 to 29	Error Check Field (2 bytes)
0B	0F	00	13	00	0A	02	CD	01	CRC

Response

The normal response will be an echo of the Server address, function code, starting address, and quantity of coils forced.

Node Address	Function Code	Coil Address High	Coil Address Low	Number of Coils High	Number of Coils Low	Error Check Field (2 bytes)
0B	0F	00	13	00	0A	CRC

The writing of coils via Modbus function 15 will be accomplished regardless of whether the addressed coils are disabled or not.

Coils that are not programmed in the controller logic program are not automatically cleared upon power up. Thus, if such a coil is set ON by function code 15 and (even months later) an output is connected to that coil, the output will be hot.

7.2.10 Preset Multiple Registers (Function Code 16)

Query

This Function Code allows the user to modify the contents of a Modbus 4x range in the server. This will write up to 125 registers at time. Since the controller is actively scanning, it also can alter the content of any holding register at any time.

Note: Function codes 5, 6, 15, and 16 are the only messages that will be recognized as valid for broadcast.

The example below is a request to write 2 registers starting at register 40002 in server 11.

Node Addrs	Func Code	Data Start Addrs High	Data Start Addrs Low	Number of Points High	Number of Points Low	Byte Count	Data High	Data Low	Data High	Data Low	Error Check Field (2 bytes)
0B	10	00	01	00	02	04	00	0A	01	02	CRC

Response

The normal response to a function 16 query is to echo the address, function code, starting address and number of registers to be loaded.

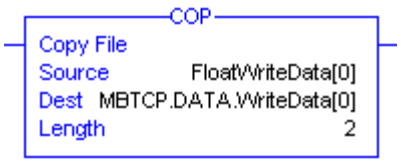
Node Address	Function Code	Data Start Address High	Data Start Address Low	Number of Points High	Number of Points Low	Error Check Field (2 bytes)
0B	10	00	01	00	02	CRC

7.3 Floating-Point Support

The movement of floating point data between the MBTCP module and other devices is easily accomplished as long as the device supports IEEE 754 Floating Point format. This IEEE format is a 32-bit single-precision floating-point format.

The logic necessary to move the floating-point data takes advantage of the COP instruction in RSLogix 5000. The COP instruction is unique for data movement commands in that it is an untyped function, meaning that no data conversion is done when data is moved between controller tags with different data types (that is, it is an image copy, not a value copy).

The COP instruction to move data from a floating-point controller tag into an integer controller tag (something you would do to move floating-point values to the module) is shown below.



This instruction will move one floating-point value in two 16-bit integer images to *MBTCP.DATA.WriteData[0]*, which is an integer tag. For multiple floating-point values increase the *Length* field by a factor of 2 per floating-point value.

The COP instruction to move data from MBTCP.DATA.ReadData[0], which is an integer tag, to a floating-point tag (something you would do to receive floating-point values from the module) is shown below.

This instruction will move two 16-bit integer registers containing one floating point value image into the floating-point tag. For multiple values increase the *Length* field.

7.3.1 ENRON Floating-Point Support

Many manufacturers have implemented special support in their drivers for what is commonly called the Enron version of the Modbus protocol. In this implementation, addresses greater than 7000 are presumed to contain floating-point values. The significance to this is that the count descriptor for a data transfer now denotes the number of floating-point values to transfer, instead of the number of words.

7.3.2 Configuring Floating-Point Data Transfer

A question commonly asked by users is how to handle floatin-point data when the module is used as a Modbus Client. This really depends on the server device and how it addresses this application.

Just because your application is reading or writing floating-point data, does not mean that you must configure the *Float Flag*, *Float Start*, and *Float Offset* parameters within the module.

These parameters are only used to support what is typically referred to as Enron or Daniel Modbus, where one register address must have 32 bits, or one floating-point value. Below is an example:

Example #1

Modbus Address	Data Type	Parameter
47101	32 bit REAL	TEMP Pump #1
47102	32 bit REAL	Pressure Pump #1
47103	32 bit REAL	TEMP Pump #2
47104	32 bit REAL	Pressure Pump #2

With the module configured as a Client, you only need to enable these parameters to support a write to this type of addressing (Modbus FC 6 or 16).

If the server device uses addressing as shown in Example #2, then you do not need to do anything with the *Float Flag* or *Float Start* parameters, as this addressing scheme uses two Modbus addresses to represent each floating=point value:

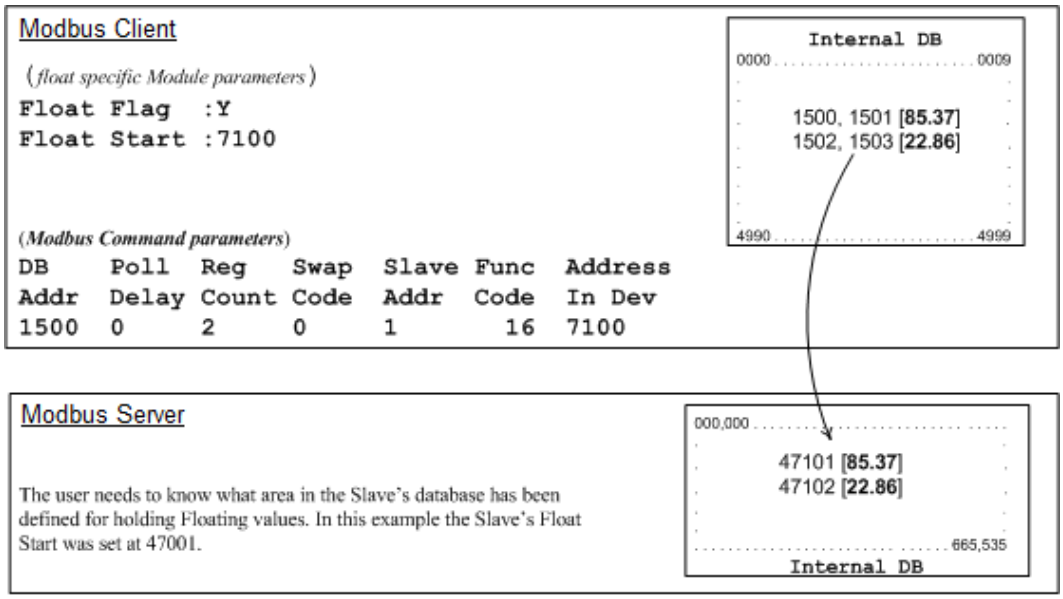
Example #2

Modbus Address	Data Type	Parameter
47101	32 bit REAL	TEMP Pump #1
47103	32 bit REAL	Pressure Pump #1
47105	32 bit REAL	TEMP Pump #2
47107	32 bit REAL	Pressure Pump #2

Because each 32-bit REAL value is represented by two Modbus addresses (example: 47101 and 47102 represent TEMP Pump #1), then you do not need to set the *Float Flag* or *Float Start* for the module for Modbus FC 6 or 16 commands being written to the server.

The next few pages show three specific examples.

Specific Example #1: Client is issuing Modbus command with FC 16 (with Float Flag: Yes) to transfer Float data to Server.



(Float specific module parameters)

Float Flag: "Y" tells the Client to consider the data values that need to be sent to the Server as floating-point data where each data value is composed of 2 words (4 bytes or 32 bits).

Float Start: Tells the Client that if this address number is <= the address number in "Addr in Dev" parameter to double the byte count quantity to be included in the Command FC6 or FC16 to be issued to the Server. Otherwise the Client will ignore the "Float Flag: Y" and treat data as composed of 1 word, 2 bytes.

(Modbus Command parameters)

DB Addr - Tells the Client where in its database is the beginning of data to obtain and write out to the Server device.

Reg Count - Tells the Client how many data points to send to the Server. Two counts will mean two floating points with Float Flag: Y and the "Addr in Dev" => the "Float Start" Parameter.

Swap Code - Tells the Client how to orient the Byte and Word structure of the data value. This is device dependent. Check Command Entry formats Section.

Func Code - Tells the Client to write the float values to the Server. FC16.

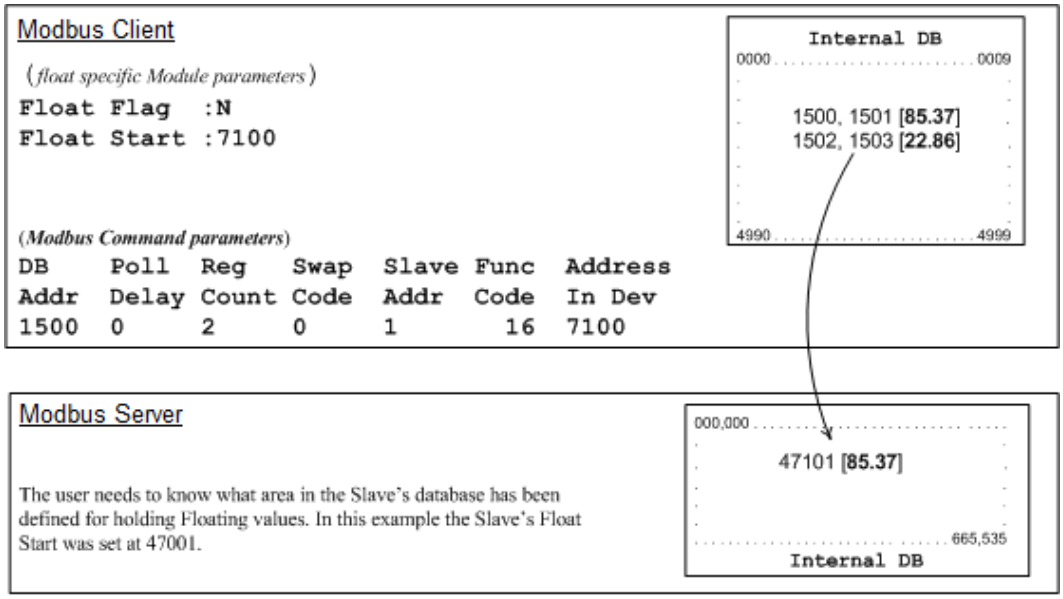
Addr in Dev - Tells the Client where in the Server's database to locate the data.

In the above example, the Client's Modbus command to transmit inside the Modbus packet will be as follows.

	Server address	Function Code	Address in Device	Reg count	Byte Count	Data	
DEC	01	16	7100	2	8	85.37	22.86
HEX	01	10	1B BC	00 02	08	BD 71 42 AA	E1 48 41 B6

In this example, the Client's Modbus packet contains the data byte and data word counts that have been doubled from the amount specified by Reg Count due to the Float flag set to Y. Some Servers look for the byte count in the data packet to know the length of the data to read from the wire. Other servers know at which byte the data begins and read from the wire the remaining bytes in the packet as the data the Client is sending.

Specific Example#2: Client is issuing Modbus command with FC 16 (with Float Flag: No) to transfer Float data.



Float Flag: "N" tells the Client to ignore the floating values and treat each register data as a data point composed of 1 word, 2 bytes or 16 bits.

Float Start: Ignored.

DB Addr - same as when Float Flag: Y.

Reg Count - Tells the Client how many data points to send to the Server.

Swap Code - same as when Float Flag: Y.

Func Code - same as when Float Flag: Y.

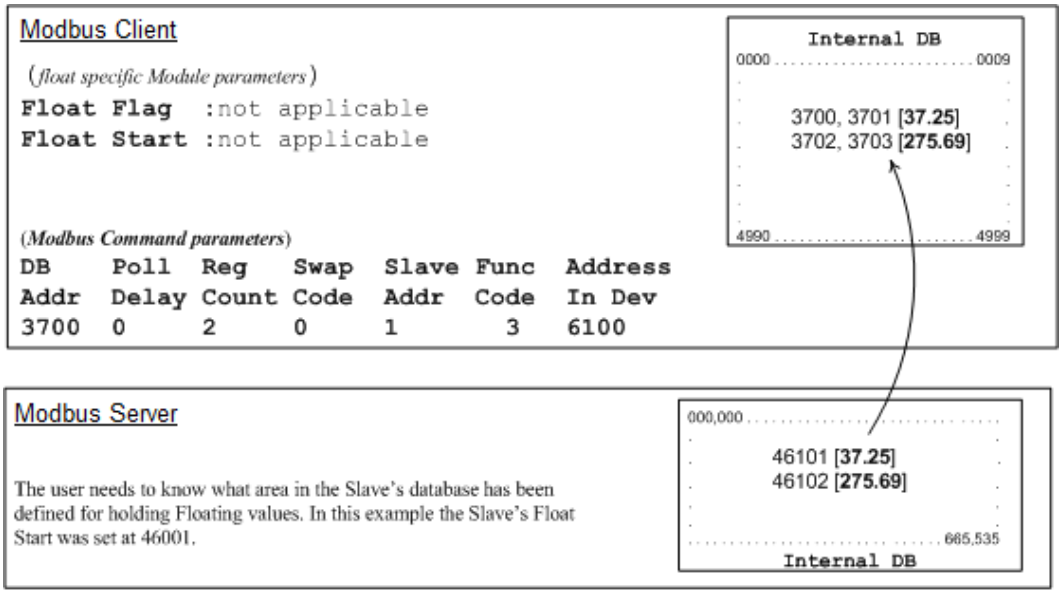
Addr in Dev - same as when Float Flag: Y as long as the Server's Float Flag = Y.

In the above example, the Client's Modbus command to transmit inside the Modbus packet will be as follows.

	Server address	Function Code	Address in Device	Reg Count	Byte Count	Data
DEC	01	16	7100	2	4	85.37
HEX	01	10	1B BC	00 02	04	BD 71 42 AA

In this example, the Client's Modbus packet contains the data byte and data word counts that have NOT been doubled from the amount specified by Reg Count due to the Float Flag set to N. The Server looks for the byte count in the data packet to know the length of the data to read from the wire. Because of insufficient byte count, some servers will read only half the data from the Client's transmission. Other servers will read all 8 bytes in this example because they will know where in the packet the data starts and ignore the byte count parameter inside the Modbus packet.

Specific Example#3: Client is issuing Modbus command with FC 3 to transfer Float data from Server.



Float Flag: Not applicable with Modbus Function Code 3.

Float Start: Not applicable with Modbus Function Code 3.

DB Addr - Tells the Client where in its data memory to store the data obtained from the Server.

Reg Count - Tells the Client how many registers to request from the Server.

Swap Code - same as above.

Func Code - Tells the Client to read the register values from the Server. FC3.

Addr in Dev - Tells the Client where in the Server's database to obtain the data.

In the above example, the Client's Modbus command to transmit inside the Modbus packet will be as follows.

	Server address	Function Code	Address in Device	Reg count
DEC	01	3	6100	2
HEX	01	03	17 D4	00 02

In the above example the (Enron/Daniel supporting) Server's Modbus command to transmit inside the Modbus packet will be as follows.

	Server address	Function Code	Byte Count	Data	
DEC	01	3	8	32.75	275.69
HEX	01	03	08	00 00 42 03	D8 52 43 89

In the above example the (a NON-Enron/Daniel supporting) Server's Modbus command that will be transmitted inside the Modbus packet will be as follows.

	Server address	Function Code	Byte Count	Data
DEC	01	3	4	32.75
HEX	01	03	04	00 00 42 03

7.4 Function Blocks

Data contained in this database is paged through the input and output images by coordination of the CompactLogix ladder logic and the MVI69L-MBTCP module's program. Each block transferred from the module to the processor or from the processor to the module contains a block identification code that describes the content of the block.

Block ID Range	Description
-1000 to -1166	Get input image data for initialization
-1 to -999	Dummy block
0	Read or write data for small data sets
1 to 167	Read or write data blocks
2000 to 2019	Event Command blocks
3000 to 3019	Client status request/response blocks
4000 to 4019	Event Sequence Command blocks
4100 to 4119	Event Sequence Command Error Status blocks
4200	Get queue and event sequence block counts
5001 to 5016	Command Control blocks
8000 to 8019	Add Event with data for a client
8100	Get Event with data status
9250	Get general module status data
9500	Set driver and command active bits
9501	Get driver and command active bits
9956	Pass-through formatted block for functions 6 and 16 with word data
9957	Pass-through formatted block for functions 6 and 16 with float data
9958	Pass-through formatted block for function 5
9959	Pass-through formatted block for function 15
9960	Pass-through formatted block for function 22
9961	Pass-through formatted block for function 23
9970	Pass-through block for function 99
9972	Set module time using received time
9973	Pass module time to processor
9997	Reset status block
9998	Warm-boot control block
9999	Cold-boot control block

7.4.1 Event Command Blocks

Blocks 2000 to 2019: Event Command

Event Command blocks send Modbus commands directly from the ladder logic to the specified MBTCP Client x. The Event Command will be added to the high-priority queue and will interrupt normal polling so this special command can be sent as soon as possible.

Note: Overuse of Event Commands may substantially slow or totally disrupt normal polling. Use Event Commands sparingly. Event Commands are meant to be used as one-shot commands triggered by special circumstances or uncommon events.

Blocks 2000 to 2019: Request from Processor to Module

Offset	Description
0	Block ID 2000 to 2019 indicates this block contains a command to execute by the Client Driver. The last two digits indicate which Client to utilize. Example: '2008' will utilize Client 8
1 to 4	IP address for the server the message is intended. Each digit (0 to 255) of the IP address is placed in one of the four registers
5	TCP service port the message will be use
6	Modbus node address to use with the message
7	Internal Modbus address in the module to be used
8	Count parameter that determines the number of digital points or registers to associate with the command
9	Swap type for integer data only.
10	Modbus function code
11	Modbus address in the slave device to be associated with the command
12 to 239	Spare

Blocks 2000 to 2019: Response from Module to Processor

Offset	Description
0	Block ID 2000 to 2019 requested by the processor
1	The next read request block identification code
2	Result of the event request. If a value of '1' is present, the command was placed in the command queue. If a value of '0' is present, no room was found in the command queue. If a value of '-1' is present, the client is not enabled and active.
3	Number of commands in queue
4 to 239	Spare

7.4.2 Client Status Request/Response Blocks

Block 3000 to 3019: Client Status Request/Response

These blocks request the status of a specific MVI69L-MBTCP Client.

Block 3000 or 3019: Request from Processor to Module

Offset	Description
0	Block ID 3000 to 3019 identification code indicates this block will request the status from a specific MVI69L-MBTCP Client. The last two digits indicate which Client to utilize. Example: '3008' will utilize Client 8
1 to 239	Spare

Block 3000 to 3019: Response from Module to Processor

Offset	Description
0	Block ID 3000 to 3019 requested by the processor
1	Write Block ID
2 to 11	Client status data
12 to 27	Command error list data for Client
28 to 239	Spare

7.4.3 Event Sequence Request Blocks

Block 4000 to 4019: Event Sequence Request

These blocks send Modbus TCP/IP commands directly from controller tags by ladder logic to the Client command priority queue on the module. Event Commands are not placed in the module's internal database and are not part of the *MNET Client x Command List* in PCB.

Block 4000 to 4019: Request from Processor to Module

Offset	Description
0	Block ID 4000 to 4019 indicates this block will trigger the event sequence of MVI69L-MBTCP client. The last two digits indicate which Client to utilize. Example: '4008' will utilize Client 8
1 to 4	IP address for the server the message is intended. Each digit (0 to 255) of the IP address is placed in one of the four registers
5	TCP service port the message will be use
6	Modbus node address to use with the message
7	Internal Modbus address in the module to be used
8	Count parameter that determines the number of digital points or registers to associate with the command
9	Swap type for integer data only.
10	Modbus function code
11	Modbus address in the slave device to be associated with the command
12	Sequence Number
13 to 239	Spare

Block 4000 to 4019: Response from Module to Processor

Offset	Description
0	Block ID 4000 to 4019 requested by the processor
1	Write Block ID
2	0=Fail, 1=Success, -1=Client is not enabled and active
3	Number of commands in queue
4 to 239	Spare

7.4.4 Event Sequence Command Error Status Blocks

Block 4100 to 4119: Event Sequence Command Error Status Request

This block displays the result of each command sent to the Client. The request includes the Client identification and the command sequence number. The response is the event count and error code for each event. A value of '0' in the error code means there was no error detected.

Block 4100 to 4119: Request from Processor to Module

Offset	Description
0	Block ID 4100 to 4119 indicates this block will trigger the event sequence command error status request of a specific MVI69L-MBTCP client. The last two digits indicate which Client to utilize. Example: '4108' will utilize Client 8
1 to 239	Spare

Block 4100 to 4119: Response from Module to Processor

Offset	Description
0	Block ID 4100 to 4119 requested by the processor
1	Write Block ID
2	Number of Event Sequence Messages in block (0 to 15)
3	Sequence Number
4	Return Error Code
5	Sequence Number
6	Return Error Code
7	Sequence Number
8	Return Error Code
…	…
…	…
31	Sequence Number
32	Return Error Code
33 to 239	Spare

7.4.5 Get Queue and Event Sequence Block Counts Block

Block 4200: Get Queue and Event Sequence Block Counts Request

This block requests the command queue count and the number of pending event sequence commands for all module Clients.

Block 4200: Request from Processor to Module

Offset	Description
0	Block ID 4200
1 to 239	Spare

Block 4200: Response from Module to Processor

Offset	Description
0	Block ID 4200
1	Write Block ID
2	Client 0 command queue count (MSB Most Significant Byte) and event sequence messages waiting (LSB Least Significant Bit)
3	Client 1 command queue count (MSB Most Significant Byte) and event sequence messages waiting (LSB Least Significant Bit)
4	Client 2 command queue count (MSB Most Significant Byte) and event sequence messages waiting (LSB Least Significant Bit)
…	…
11	Client 9 command queue count (MSB Most Significant Byte) and event sequence messages waiting (LSB Least Significant Bit)
10 to 239	Spare

7.4.6 Command Control Blocks

Block 5001 to 5016: Command Control

Command Control blocks place commands into the module's command priority queue. Unlike Event Command blocks, which contain all the values needed for one command, Command Control is used with commands already defined in the *MNET Client x Command List* in PCB.

Block 5001 to 5016: Request from Processor to Module

Offset	Description
0	Command queue block identification code of 5001 to 5016
1	Client index (0 to 9) to be used
2	Command Index in the command list for the first command to be entered into the command queue
3 to 17	Command indexes of the next commands to be placed in the command queue
18 to 239	Spare

Block 5001 to 5016: Response from Module to Processor

Offset	Description
0	Command queue block identification code of 5001 to 5016
1	The next write block ID
2	Client index (0 to 9) to be used
3	Number of commands in the block placed in the command queue. If a value of -2 is returned, then the client index is not valid. If a value of -1 is returned, the client is not enabled and active.
4	Number of commands in queue
5 to 239	Spare

7.4.7 Add Event with Data for Client Blocks

Block 8000: Add Event with Data for Client

The 8000-series blocks are similar to the 2000-series Event Command blocks. The 8000-series blocks source the command data from the processor, instead of from the module's database. These blocks use 'write' Modbus Function Codes (5, 6, 15, 16) only.

Block 8000: Request from Processor to Module

Offset	Description
0	Block ID 8000 indicates this block will add an event with data of a specific MVI69L-MBTCP client. The last two digits indicate which Client to utilize. Example: '8008' will utilize Client 8
1 to 4	IP address for the server the message is intended. Each digit (0 to 255) of the IP address is placed in one of the four registers
5	TCP service port the message will be use
6	Modbus node address to use with the message
7	Modbus Function Code: 5, 6, 15 or 16 only
8	Modbus address in the slave device to be associated with the command
9	Count value for operation- bit count for function 15 (1 to 800 points) and word count for function 16 (1 to 50 words or 1 to 25 float values). For functions 5 and 6, the count is assumed to be 1.
10 to 59	Data values to be used by command
60 to 239	Spare

Block 8000: Response from Module to Processor

Offset	Description
0	Block ID 8000 for event command with data request
1	The next read request block identification code
2	Error Code for request: 0=No error -1=Client is not enabled -3=Client is not active -4=Client busy with previous event command -5=Invalid Modbus command -6=Invalid point count for command
3 to 239	Spare

7.4.8 Get Event with Data Status Block

Block 8100: Get Event with Data Status

This block requests status data for Event with Data Commands.

Block 8100: Request from Processor to Module

Offset	Description
0	Block ID 8100 status data request for Event with Data Commands.
1 to 239	Spare

Block 8100: Response from Module to Processor

Offset	Description
0	Block ID 8100 status data for Event with Data Commands
1	The next read request block identification code
2	Number of client records contained in block (0-19)
3	Client Index (0 to 9)
4	Error code for last command executed for Client
5	Client Index (0 to 9)
6	Error code for last command executed for Client
7 to 42	Data for other clients being reported
43 to 239	Spare

7.4.9 Get General Module Status Data Block

Block 9250: Get General Module Status Data

This block is used to request general module status

Block 9250: Request from Processor to Module

Offset	Description
0	Block ID 9250 to request the general module status response block

Block 9250: Response from Module to Processor

Offset	Description
0	Block ID 9250 requested by processor
1	The next read request block identification code
2	Program Scan Count: This value is incremented each time a complete program cycle occurs in the module
3 to 4	Product Code: These two registers contain the product code of "MB6E" for the MVI69L-MBTCP module
5 to 6	Product Version: These two registers contain the product version for the current running software
7 to 8	Operating System: These two registers contain the month and year values for the program operating system
9 to 10	Run Number: These two registers contain the run number value for the currently running software.
11	Read Block Count: Total number of read blocks transferred from the module to the processor
12	Write Block Count: Total number of write blocks transferred from the processor to the module
13	Parse Block Count: Total number of blocks successfully parsed that were received from the processor
14	Event Command Block Count: Total number of Event Command blocks received from the processor
15	Command Block Count: Total number of command blocks received from the processor
16	Error Block Count: Total number of block errors recognized by the module.
17	Client 0 command execution word. Each bit in this word is used to enable/disable the commands for client 0. If the bit is set, the command will execute. If the bit is clear, the command will be disabled
18 to 36	Client 1 to Client 9 command execution words
37 to 38	Event Sequence Ready. Bit mapped -1 bit for each Client 0 to 9 Bit=0, No event sequence status data ready Bit=1, Event seq. status data ready

Offset	Description
39	Encapsulated Modbus TCP/IP request count: This counter increments each time an Encapsulated Modbus TCP/IP (Service Port 2000) request is received from a remote Modbus TCP/IP client
40	Encapsulated Modbus TCP/IP response count: This counter increments each time an Encapsulated Modbus TCP/IP (Service Port 2000) response is sent back to a remote Modbus TCP/IP client command
41	Encapsulated Modbus TCP/IP error sent: This counter increments each time an error is sent from the server to the remote Modbus TCP/IP client
42	Encapsulated Modbus TCP/IP error received: This counter increments each time an error is received from a remote Modbus TCP/IP client
43	Modbus MBAP request count: This counter increments each time an MBAP (Service Port 502) request is received from a remote Modbus TCP/IP client
44	Modbus MBAP response count: This counter increments each time an MBAP (Service Port 502) response is sent back to a remote Modbus TCP/IP client command
45	Modbus MBAP error sent: This counter increments each time an error is sent from the server to the remote MBAP Modbus TCP/IP client
46	Modbus MBAP error received: This counter increments each time an error is received from a remote MBAP Modbus TCP/IP client
47 to 239	Spare

7.4.10 Set Driver and Command Active Bits Block

Block 9500: Set Driver and command active bits

This block enables and disables the Modbus TCP/IP Clients and Servers of the module.

Block 9500: Request from Processor to Module

Offset	Description
0	Block ID 9500 to set server and client enable/disable state
1	Server active state 0=Disabled, 1=Enabled
2	Client 0 to15 bit map for active status of clients
3	Spare
4 to 13	Client 0 to Client 9 command active bits. One word for each client with each bit used to turn on and off the commands for the client. 0=Disabled, 1=Enabled
24 to 239	Spare

Block 9500: Response from Module to Processor

Offset	Description
0	Block ID 9500 requested by processor
1	The next write block ID
2 to 239	Spare

7.4.11 Get Driver and Command Active Bits Block

Block 9501: Get driver and command active bits

This block requests the active state of MBTCP Driver and Client commands.

Block 9501: Request from Processor to Module

Offset	Description
0	Block ID 9501 to get MBTCP Driver and command active status
1 to 239	Spare

Block 9501: Response from Module to Processor

Offset	Description
0	Block ID 9501 requests the active state of MBTCP Driver and Client commands
1	The next write block ID
2	Server active state 0=disabled, 1=enabled
3	Client 0 to 15 bit map for active status of clients
4	Spare
5 to 14	Client 0 to Client 9 command active bits. One word for each client with each bit used to turn on and off the commands for the client. 0=Disabled, 1=Enabled
25 to 239	Spare

7.4.12 Pass-through Formatted Block for Functions 6 and 16 with Word Data Block

Block 9956: Pass-through Formatted Block for Functions 6 and 16 with Word Data Block

If the server port on the module is configured for formatted pass-through mode, the module will send input image blocks with identification codes of 9956, 9957, 9958 or 9959 to the processor for each write command received. Any incoming Modbus Function 5, 6, 15 or 16 command will be passed from the port to the processor using a block identification number that identifies the Function Code received in the incoming command.

The MBTCP Add-On Instruction will handle the receipt of all Modbus write functions and to respond as expected to commands issued by the remote Modbus Client device.

Note: Mutual exclusion on Pass-Through Block IDs 9956, 9957, 9958, and 9959 from all server connections - When multiple server connections are active and they receive write commands with the same Function Code, the same block identifier from the above list is needed. The module will process the command from the server which first received a command.
The module will return an Exception Code error code 6 (Node is busy - retry command later error) from the other server that received the command last. The Client will retry the command on the busy port after a short delay. This prevents Pass-Through blocks on multiple servers from overwriting each other.

Block 9956: Request from Module to Processor

Offset	Description
0	Block ID 9956
1	Block ID 9956
2	Number of word registers in Modbus data set
3	Starting address for Modbus data set
4 to 53	Modbus Data

The ladder logic will be responsible for parsing and copying the received message and performing the proper control operation as expected by the Client device. The processor must then respond to the pass-through control block with an output image write block with the following format.

This informs the module that the command has been processed and can be cleared from the pass-through queue.

Block 9956: Response from Processor to Module

Offset	Description
0	Block ID 9956
1 to 239	Spare

7.4.13 Pass-through Formatted Block for Functions 6 and 16 with Float Data Block

Block 9957: Pass-through Formatted Block for Functions 6 and 16 with Float Data Block

Block 9957: Request from Module to Processor

Offset	Description
0	Block ID 9957
1	Block ID 9957
2	Number of word registers in Modbus data set
3	Starting address for Modbus data set
4 to 53	Modbus Data

The ladder logic will be responsible for parsing and copying the received message and performing the proper control operation as expected by the Client device. The processor must then respond to the Pass-through block with a write block with the following format.

Block 9957: Response from Processor to Module

Offset	Description
0	Block ID 9957
1 to 239	Spare

This will inform the module that the command has been processed and can be cleared from the pass-through queue.

7.4.14 Pass-through Formatted Block for Function 5

Block 9958: Pass-through Formatted Block for Function 5

Block 9958: Request from Module to Processor

Offset	Description
0	Block ID 9958
1	Block ID: 9958
2	Number of word registers in Modbus data set
3	Starting address for Modbus data set
4 to 53	Modbus Data

The ladder logic will be responsible for parsing and copying the received message and performing the proper control operation as expected by the Client device. The processor must then respond to the pass-through control block with an output image write block with the following format.

Block 9958: Response from Processor to Module

Offset	Description
0	Block ID 9958
1 to 239	Spare

This will inform the module that the command has been processed and can be cleared from the pass-through queue.

7.4.15 Pass-through Formatted Block for Function 15

Block 9959: Pass-through Formatted Block for Function 15

When the module receives a function code 15 in pass-through mode, the module will write the data using block ID 9959 for multiple-bit data. First the bit mask clears the bits to be updated. This is accomplished in RSLogix 5000 by ANDing the inverted mask with the existing data.

Next, the new data ANDed with the mask is ORed with the existing data. This protects the other bits in the INT registers from being affected.

Block 9959: Request from Module to Processor

Offset	Description
0	Block ID 9959
1	Block ID 9959
2	Length in words
3	Data address
4 to 28	Modbus Data
29 to 53	Bit mask to use with the data set. Each bit to be considered with the data set will have a value of 1 in the mask. Bits to ignore in the data set will have a value of 0 in the mask.
54 to n	Spare

The ladder logic will be responsible for parsing and copying the received message and performing the proper control operation as expected by the Client device. The processor must then respond to the pass-through control block with a write block with the following format.

Block 9959: Response from Processor to Module

Offset	Description
0	Block ID 9959
1 to n	Spare

This will inform the module that the command has been processed and can be cleared from the pass-through queue.

7.4.16 Pass-through Formatted Block for Function 22

Block 9960: Pass-through Formatted Block for Function 22

Block 9960: Request from Module to Processor

Offset	Description
0	Block ID 9960
1	Block ID 9960
2	Number of word registers in Modbus data set
3	Starting address for Modbus data set
4 to 53	Modbus Data

The ladder logic will be responsible for parsing and copying the received message and performing the proper control operation as expected by the Client device. The processor must then respond to the pass-through control block with an output image write block with the following format.

Block 9960: Response from Processor to Module

Offset	Description
0	Block ID 9960
1 to 239	Spare

This will inform the module that the command has been processed and can be cleared from the pass-through queue.

7.4.17 Pass-through Formatted Block for Function 23

Block 9961: Pass-through Formatted Block for Function 23

Block 9961: Request from Module to Processor

Offset	Description
0	Block ID 9961
1	Block ID 9961
2	Number of word registers in Modbus data set
3	Starting address for Modbus data set
4 to 53	Modbus Data

The ladder logic will be responsible for parsing and copying the received message and performing the proper control operation as expected by the Client device. The processor must then respond to the pass-through control block with an output image write block with the following format.

Block 9961: Response from Processor to Module

Offset	Description
0	Block ID 9961
1 to 239	Spare

This will inform the module that the command has been processed and can be cleared from the pass-through queue.

7.4.18 Pass-through Block for Function 99

Block 9970: Pass-through Block for Function 99

Block 9970: Request from Module to Processor

Offset	Description
0	Block ID 9970
1	Block ID 9970
2	1
3	0
4 to 239	Spare

The ladder logic will be responsible for parsing and copying the received message and performing the proper control operation as expected by the Client device. The processor must then respond to the pass-through control block with an output image write block with the following format.

Block 9970: Response from Processor to Module

Offset	Description
0	Block ID 9970
1 to 239	Spare

This will inform the module that the command has been processed and can be cleared from the pass-through queue.

7.4.19 Set Module Time Using Received Time Block

Block 9972: Set Module Time Using Received Time Block

This block will use the time information of the processor to set the module time.

Block 9972: Request from Processor to Module

Offset	Description
0	Block ID 9972
1	Year (0-9999)
2	Month (1-12)
3	Day (1-31)
4	Hour (0-23)
5	Minutes (0-59)
6	Seconds (0-59)
7	Milliseconds (0-999)
8 to 239	Spare

Block 9972: Response from Module to Processor

Offset	Description
0	Block ID 9972
1	Write Block ID
2	Return code 0=OK, -1=error
3 to 239	Spare

7.4.20 Pass Module Time to Processor Block

Block 9973: Pass Module Time to Processor Block

This block will use the time information of the module to set the processor time.

Block 9973: Request from Processor to Module

Offset	Description
0	Block ID 9973
1 to 239	Spare

Block 9973: Response from Module to Processor

Offset	Description
0	Block ID 9973
1	Write Block ID
2	Year (0-9999)
3	Month (1-12)
4	Day (1-31)
5	Hour (0-23)
6	Minutes (0-59)
7	Seconds (0-59)
8	Milliseconds
9 to 239	Spare

7.4.21 Reset Status Block

Block 9997: Reset Status Block

This block will reset the module and client/server status.

Block 9997: Request from Processor to Module

Offset	Description
0	Block ID 9997
1	Reset Module status (0=no, else yes)
2	Reset Port 1 status (0=no, else yes)
3 to 239	Spare

Block 9997: Response from Module to Processor

Offset	Description
0	Block ID 9997
1	Write Block ID
2 to 239	Spare

7.4.22 Warm-boot Control Block

Block 9998: Warm-boot Control Block

If the CompactLogix sends a block number 9998, the module will perform a warm-boot operation. The module will reconfigure the communication ports and reset the error and status counters.

Block 9998: Request from Processor to Module

Offset	Description
0	Block ID 9998
1 to 239	Spare

7.4.23 Cold-boot Control Block

Block 9999: Cold-boot Control Block

If the CompactLogix processor sends a block number 9999, the firmware will perform a cold-boot operation. The firmware will reload the configuration file and reset all MBTCP memory, error and status data.

Block 9999: Request from Processor to Module

Offset	Description
0	Block ID 9999
1 to 239	Spare

7.5 Ethernet Cable Connections

7.5.1 Ethernet Cable Specifications

The recommended cable is Category 5 or better. A Category 5 cable has four twisted pairs of wires, which are color-coded and cannot be swapped. The module uses only two of the four pairs.

The Ethernet port on the module is Auto-Sensing. A standard Ethernet straight-through cable or a crossover cable can be used when connecting the module to an Ethernet hub, a 10/100 Base-T Ethernet switch, or directly to a PC. The module will detect the cable type and use the appropriate pins to send and receive Ethernet signals.

Some hubs have one input that can accept either a straight-through or crossover cable, depending on a switch position. In this case, ensure the switch position and cable type agree.

7.5.2 Ethernet Performance

Ethernet performance on the MVI69L-MBTCP module can affect the operation of the MBTCP application ports in the following ways.

- Accessing the web interface (refreshing the page, downloading files, and so on) may affect performance
- High Ethernet traffic may impact performance (consider using managed switches to reduce traffic coming to module port).

8 Support, Service & Warranty

In This Chapter

- Contacting Technical Support 149
- Warranty Information..... 150

8.1 Contacting Technical Support

ProSoft Technology, Inc. (ProSoft) is committed to providing the most efficient and effective support possible. Before calling, please gather the following information to assist in expediting this process:

1. Product Version Number
2. System architecture
3. Network details

If the issue is hardware related, we will also need information regarding:

1. Module configuration and associated ladder files, if any
2. Module operation and any unusual behavior
3. Configuration/Debug status information
4. LED patterns
5. Details about the serial, Ethernet or fieldbus devices interfaced to the module, if any.

Note: *For technical support calls within the United States, ProSoft's 24/7 after-hours phone support is available for urgent plant-down issues. Detailed contact information for all our worldwide locations is available on the following page.*

Internet	Web Site: www.prosoft-technology.com/support E-mail address: support@prosoft-technology.com
Asia Pacific (location in Malaysia)	Tel: +603.7724.2080, E-mail: asiapc@prosoft-technology.com Languages spoken include: Chinese, English
Asia Pacific (location in China)	Tel: +86.21.5187.7337 x888, E-mail: asiapc@prosoft-technology.com Languages spoken include: Chinese, English
Europe (location in Toulouse, France)	Tel: +33 (0) 5.34.36.87.20, E-mail: support.EMEA@prosoft-technology.com Languages spoken include: French, English
Europe (location in Dubai, UAE)	Tel: +971-4-214-6911, E-mail: mea@prosoft-technology.com Languages spoken include: English, Hindi
North America (location in California)	Tel: +1.661.716.5100, E-mail: support@prosoft-technology.com Languages spoken include: English, Spanish
Latin America (Oficina Regional)	Tel: +1-281-2989109, E-Mail: latinam@prosoft-technology.com Languages spoken include: Spanish, English
Latin America (location in Puebla, Mexico)	Tel: +52-222-3-99-6565, E-mail: soporte@prosoft-technology.com Languages spoken include: Spanish
Brasil (location in Sao Paulo)	Tel: +55-11-5083-3776, E-mail: brasil@prosoft-technology.com Languages spoken include: Portuguese, English

8.2 Warranty Information

For complete details regarding ProSoft Technology's TERMS & CONDITIONS OF SALE, WARRANTY, SUPPORT, SERVICE AND RETURN MATERIAL AUTHORIZATION INSTRUCTIONS please see the documents on the Product DVD or at www.prosoft-technology.com/legal

All documentation is subject to change without notice.

Index

A

About the Modbus Protocol • 108
Add Event with Data for Client Blocks • 133
Adding Multiple Modules in the Rack • 36
Add-On Instruction • 17
Add-On Profile • 25

B

Backplane Data Exchange • 67
Backplane Data Transfer • 68
Block ID List • 126

C

Clearing a Fault Condition • 93
Client Driver Overview • 73
Client Status Request/Response Blocks • 128
Command Control Blocks • 132
Configuration Parameters • 49
Connecting Your PC to the Module's Ethernet Port • 94
Contacting Technical Support • 149
Controller Tag Overview • 80
Controller Tags • 76
Creating a New RSLogix 5000 Project • 24
Creating the Module in an RSLogix 5000 Project • 25

D

Data Flow Between the Module and Processor • 71
Deployment Checklist • 11
Diagnostics and Troubleshooting • 91
Diagnostics Menu Connectivity using PCB • 97
Diagnostics Menu Navigation • 99
Downloading the Configuration File to the Processor • 60
DVD Contents • 16

E

Error Codes • 103
Ethernet 1 • 58
Ethernet Cable and Performance • 148
Ethernet LED Indicators • 92
Event Command Blocks • 127
Event Sequence Command Error Status Blocks • 130
Event Sequence Request Blocks • 129

F

Floating Point Support • 120
Floating-Point Data Transfer Configuration • 121
Function Code Definitions • 109

G

General Specifications - Modbus Client/Server • 106
Generating the AOI (.L5X) File in ProSoft Configuration Builder • 19
Get Driver and Command Active Bits Block • 138
Get Event with Data Status Block • 134
Get General Module Status Data Block • 135
Get Queue and Event Sequence Block Counts Block • 131

H

Hardware Specifications • 107
How to Contact Us • 2

I

Important Safety Information • 3
Importing the Add-On Instruction • 33
Installing ProSoft Configuration Builder • 18
Installing the Module in the Rack • 13

L

LED Status Indicators • 92

M

MBTCP Client x • 52
MBTCP Client x Commands • 55
MBTCP Servers • 50
MBTCP.CONFIG • 80
MBTCP.CONTROL • 81
MBTCP.DATA • 80
MBTCP.STATUS • 86
MBTCP.UTIL • 89
Modbus Error Codes • 103
Modbus Function Codes • 109
Module • 49
MVI69E-MBTCP Configuration • 45
MVI69E-MBTCP Controller Tags • 76

N

Normal Data Transfer • 69

P

Package Contents • 11
Pass Module Time to Processor Block • 145
Pass-through Block for Function 99 • 144
Pass-Through Control Blocks • 50
Pass-through Formatted Block for Function 15 • 142
Pass-through Formatted Block for Function 22 • 143
Pass-through Formatted Block for Function 23 • 143
Pass-through Formatted Block for Function 5 • 141
Pass-through Formatted Block for Functions 6 and 16 with Float Data Block • 140
Pass-through Formatted Block for Functions 6 and 16 with Word Data Block • 139
PCB Functions • 46
Permanent IP Address • 58
Printing a Configuration File • 48

Product Specifications • 106

R

Read and Write Block Transfer Sequences • 70
Read Block
    Response from the Module to the Processor • 69
Reference • 105
Renaming PCB Objects • 46
Reset Status Block • 146

S

Server Driver Overview • 71
Set Driver and Command Active Bits Block • 137
Set Module Time Using Received Time Block • 145
Setting Up a Temporary IP Address • 94
Setup Jumper • 12
Start Here • 9
Static ARP Table • 59
Sub-function Codes • 116
Support, Service & Warranty • 149
System Requirements • 10

T

Troubleshooting the LEDs • 93

U

Uploading the Configuration File from the Processor to PC • 63
User-Defined Data Types (UDTs) • 78
Using Controller Tags • 75

W

Warranty Information • 150
Webpage • 104
Write Block
    Request from the Processor to the Module • 69

Y

Your Feedback Please • 2